An Economic Framework for Traffic Planning in Greater Melbourne

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Abstract. Economics-based policies are proposed for ameliorating Melbourne's traffic congestion. A suite of direct and indirect demand-side strategies is suggested. This includes a cordon pricing scheme for the central city area, including the CBD, along with parking policies which address boundary problems on the cordon perimeter. Curb-side pricing of major arterials and of the two major ring-roads is proposed at short-run marginal cost rather than the current cost-recovery plus margin basis. This should be promoted along with 'traffic calming' policies on smaller auxiliary urban roads to limit 'rat-running' and promote urban environmental quality. Contracts on existing and proposed tollways should be renegotiated. Auxiliary public transport pricing reform is advocated with competition being promoted and fares related to marginal not average costs. Consequent higher transport sector deficits should be funded, in part, by revenues from congestion charges on roads. Policies of concentrating urban expansion on Melbourne's boundary, where it is served by radial transport links, are criticised. Transport and urban planning policies are suggested for the city periphery, including the retention of greenbelt areas, along the lines of the State Government's 'Melbourne 2030' policy of imposing strict city boundaries with development of new self-contained urban communities. The overall suite of policies proposed is a stop-gap which brings Melbourne's congestion closer to efficient levels and facilitates an eventual transition to comprehensive electronic pricing.

1. **Introduction.**

Melbourne has the size, population density and car ownership levels of many North American cities but levels of public transport infrastructure usually found in European cities. Although possessing above-average levels of public transport it still faces interrelated problems of expanding public transport infrastructure and of dealing with high car dependence. Melbourne experiences socially-costly traffic congestion that amounts to gross losses of billions of dollars annually. The costs include wasted time, increased stress and fatigue, excessive fuel and maintenance costs, lower worker productivity, increased transport capital requirements, reduced business competitiveness and loss of an otherwise aesthetically pleasing and healthy environment. Although these costs can be reduced with demand-side policies, roads are the only public utility not targeted for efficient pricing by the Victorian Government.

Comprehensive 'first-best' pricing of Melbourne's roads by satellite monitoring is impractical in the short-term due to high start-up costs relative to current congestion costs. However, inexpensive demand-side policies can be utilised that will reduce congestion and permit more cost-efficient peak period travel. This paper exposits a suite of such policies. Section 2 overviews Melbourne's transport system. Section 3 analyses congestion policies emphasising the superiority of demand-side tactics and, particularly, effective cordon pricing of the CBD. Supply-side strategies, information policies, indirect demand-side strategies and various other policies are also discussed. Section 4 outlines a plan to relieve radial and central traffic congestion via curb-side pricing, cordon pricing and 'traffic calming'. Section 5 explains why direct demand-side strategies are generally unsuited to cross-town travel and proposes an alternative suite of indirect strategies to reduce cross-town congestion. Section 6 offers conclusions and final remarks.

2. Melbourne's Transportation System

Melbourne's sprawling metropolis wraps around the shores of Port Philip Bay, stretching 50 km east to west and 70 km north to south. It is a large city: As conventionally defined, Melbourne covers 1,700 square kilometres and is home to 3.3 million residents.

Melbourne splits into two zones, a central-cum-inner-suburban region and a surrounding periphery. Its CBD and inner suburbs were developed during the nineteenth century before motor transport was widely available. The compact CBD has high population density and few high capacity roads. It is Melbourne's commercial centre and, together with the inner suburbs, hosts one third of all jobs. On an average weekday over half a million people travel within the City of Melbourne with sixty three per cent of these trips by car (City of Melbourne (2000, 4.3)). The CBD is the largest retail centre with turnover three times that of the largest alternative free-standing shopping mall (Cervero (1998, p.334)).

Melbourne's inner suburbs comprise compact, affluent residential areas with pockets of commerce and industry. These suburbs offer residents easy access to local commerce, amenities, and the neighbouring CBD. They have high population densities of 45-60 people per hectare. Residents have convenient access to public transport and are less car-dependent than those living in the periphery (Cervero (1998, p.332-334)).

Melbourne's periphery developed with the urban railway, built in the late nineteenth century, which introduced fast travel within Melbourne and allowed residents to live in large freestanding houses, distant from industry and commerce. This created low-density residential corridors along rail lines. The introduction of the motor car facilitated cross-town travel so land between the rail corridors was eventually developed as urban centres.

The periphery comprises mainly detached single-family homes with gardens. Residential areas are generally segregated from industrial and commercial areas with population densities of only 14.9 persons per hectare (pph). These are among the lowest urban densities in cities outside the United States (Dept. Infrastructure (2002, p. 58))[1]. The long distances that must be travelled by residents in the periphery to work and for other journeys rule out walking and bicycling and low population densities undermine the economies required for mass transit. Cars are the practical travel mode so the periphery has high car-dependence.

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[1] By way of comparison, Montreal and Toronto, which have a similar populations, have population densities of 33.8 pph and 41.5 pph respectively (Dept. Inf.rastructure (2002, p.58)).

Since the 1960s Greater Melbourne has experienced high growth in car dependence. For example from 1961-1991 while its population grew by 53 per cent and the total road network grew by 44 per cent, vehicles registered grew by 237 per cent. Over this period 'passenger boardings' on buses, trains and trams fell 31 per cent (Kensworthy & Laube (1999)).

The TRC (1992) estimate that of all trips in Melbourne 14 per cent are for travel to work, 10 per cent are education related, 20 per cent are for shopping and 26 per cent are social or recreational. Many journeys are non-radially directed cross-town journeys which poses specific problems. For example only one third of work-related journeys are directed to the city centre and, of these, only one third is by public transport. However marginal costs of congestion in Melbourne *are* concentrated within its CBD (59 per cent of total costs), its inner arterial roads (20 per cent), freeways (14 per cent) and other arterials (7 per cent): see Litman (2002b, p. 5.5-9).

2.1 Public transport infrastructure. Public transport infrastructure has evolved as the result of *ad hoc* adjustments to immediate needs. The costs of this infrastructure are substantial. The Victorian State Government spent $3 billion on transport in 2002-2003 (Dept. Infrastructure (2002, p.24)) of which $464 million was on roads (Leone (2003)). Responsibility for roads is shared, with the Federal Government responsible for national highways, and with 32 Local Governments responsible for tributary roads. The State agency responsible for management of primary and secondary arterial roads is VicRoads. Since its inception VicRoads has predicted and provided transport requirements from a supply perspective.

Melbourne's road network follows a disjointed grid. Each major road forms a grid square composed of tributary roads. Major roads do not run the width of the city so drivers need regularly to change roads to make cross-town journeys. The arterial roads were later additions that radiate out from central Melbourne.

Most of Melbourne's roads are unpriced and, because drivers prefer to travel to similar locations at similar times, are subject to congestion at peak times. Road users only pay for a fraction of the social costs they impose[2]. They do not bear the costs of

[2] Internalised car use costs account for only 44 per cent of total vehicle costs (Litman, (1999, p. 2) while non-motorists bear the brunt of approximately 32 per cent of external motor vehicle costs.

delay their road use causes others or for pollution, noise, road construction, maintenance and accident costs imposed. Drivers also benefit from fringe benefit tax concessions that favour salary packaging linked to private transport. Where road pricing is practiced, as on CityLink's Tollway or where it is anticipated to be practiced such as on the Mitcham-Frankston Project, it is (or will be) cost-recovery not efficiency-based with excessive off-peak tolls: for discussion see Appendix 2.

Melbourne has one of the world's largest urban train networks and the fourth largest tram network. Yet only about 12.5 per cent of citizens use public transport daily (ABS (1996, p. 4.3)). Indeed many Melbournians live beyond walking distance to public transport and only a small proportion of jobs can be conveniently reached by public transport. Hence, though it has been bolstered by heavy subsidies, public transport has been subject to low demands. In the past, transport deficits have been over a billion dollars per year or $1,670 per passenger (Industry Commission (1994, p 75-77)). Train and tram subsidies are forecast to be $2.3 billion over the five years from 2004 (Heasley (2004)).

Public transport is an imperfect substitute for car travel. It is less convenient, and more expensive. Public transport, moreover, caters primarily for radial trips, accounting for 36 per cent of radial trips compared to 9 per cent of total trips (Dept. Inf. (2002, p. 39)).

Recently the Government privatized public transport as regulated and subsidized monopolies. The urban train network is operated by the private corporation, Connex, the tram network by Yarra Tram and buses primarily by the National Bus Company.

Trains are primarily used by long distance, radial commuters. They provide efficient travel to the CBD, where 85 per cent of jobs are located within a five minutes walk of a station (Cervero (1998, p. 323)). Melbourne has no cross-town railway lines. Connex currently receives a subsidy of $345 million per year: See Yarra Trams (2004).

The tram network forms a grid covering the inner suburbs, with an occasional offshoot into the periphery. The high patronage of the trams for local journeys is due to the regular services provided and the surrounding high population densities.

Nevertheless, Yarra Trams receives a subsidy of $112 million per year (Yarra Trams (2004)).

Buses are concentrated in areas that were developed after the advent of cars but not serviced by rail or tram. Buses usually travel cross-town to train stations, schools or peripheral shopping centres where they often follow meandering routes through suburbs. Their low patronage is due to their irregular service that in turn reflects the low surrounding population densities.

2.2 Traffic congestion: Causes. Melbourne's traffic congestion is the result of inefficiently priced private and public transport, urban development subsidies and the lack of an effective urban planning and transport policy. Civil engineers at VicRoads, with a supply orientation, have dominated transport management and have focused on predicting demand at subsidized private transport prices and then seeking to provide requisite infrastructure. Little attempt has been made to manage demand using economic instruments.

Road supplies within central Melbourne are for practical purposes fixed because of prohibitively high costs of acquiring intensively developed land. Increasing the supply of peripheral roads makes more commercial sense, and has electoral appeal, but is subject to 'triple convergence' issues as discussed below in Section 3.6. Providing more roads releases latent demands for travel, which tends to restore pre-existing congestion. Also, providing high capacity radial arterial roads in the periphery reduces travel costs there and increases the appeal of cheaper peripheral housing, resulting in urban sprawl which offsets the benefits of initial road expansions. Commerce and industry follow residents into the periphery far from public transport corridors, increasing demand for cross-town travel.

Public transport has come to be seen as a poor substitute for car travel. Only 9 per cent of motorized trips are on public transport (Dept. Infrastructure. (2002, p. 39)). Low price elasticities of public transport demand and low cross price elasticities, with respect to car travel, undermine the effectiveness of expensive subsidy policies.

2.3 Traffic congestion: Costs. Congestion imposes significant costs. Increased travel time cuts into leisure and work time with costs conventionally valued at about 50 per cent of a commuter's wage (Small (1992, p. 44)). Other costs include stress and fatigue and increased costs of fuel and maintenance. There are also specific costs to the transport sector, of major importance[3] to Victoria. Traffic congestion reduces the productivity of transport capital by increasing its input requirements.

Congestion has adverse macroeconomic effects by decreasing productivity. It also implies inefficient usage of fuel, automobiles and spare parts and reduced efficiency of road-based public transport, with slower, less reliable journeys. Congestion increases emissions of dangerous pollutants, including benzene, lead, photochemical smog and nitrogen oxides[4]. These chemicals have health effects of concern in Melbourne because the city is ringed by mountains that trap pollutants. Moreover, pollution, vibration and noise caused by congestion decrease the environment's aesthetic appeal.

There are no sound, up-to-date estimates of total congestion costs in Melbourne. Some dated estimates suggest costs of $2 billion dollars per year (Industry Commission (1994, p. 220)). These are *gross cost* estimates not deadweight loss estimates since they compare travel times with congestion times under free-flow conditions[5]. This exaggerates net costs in one sense but understates it in another by ignoring indirect costs such as pollution. Observed traffic delays suggest there are significant deadweight losses to Melbournians from traffic congestion. Preliminary BTCE (1996) estimates for 1995 of net congestion costs in Melbourne confirm this. The BTCE estimated deadweight losses in Melbourne from failing to price of $466 million implying a 2005 cost of $698 million assuming (i) 11 per cent population growth, (ii) 23 per cent inflation and (iii) 12 per cent growth in the per capita car fleet size This is a rough estimate. Supply improvements are ignored as are nonlinearities in the relation between vehicle numbers and travel times. For example, VicRoads estimate travel times on sections of the Westgate Freeway, the Western Ring Road ,

[3] Transport services account for $17 billion of Victorian output, or 10 per cent of gross State product. Freight movements within Melbourne cost $2 billion annually (FDL Management (2001, p.1)).

[4] Congestion generates increased pollution because, with heavy congestion, fuel consumption can increase by 30 per cent. See Litman (2002b, p.5.5-9)).

[5] The same erroneous gross figures are presented in the Business Council of Australia report prepared by Port Jackson Partners Limited (2005) where officially-provided data suggest congestion cost increases from $2.7 billion to $8 billion over 2001-2021. This report also provides estimates of Melbourne's congestion based on the fraction of roads subject to congestion and on traffic speeds that likewise do not accurately capture the deadweight costs of congestion.

CityLink and the Eastern Freeway have doubled from 1994-2003 (Silkstone (2004)). Further, this estimate ignores growth in vehicle usage intensity[6].

3. Congestion Policies

The existence of congestion and other traffic externalities suggests gains can be realized with active policy interventions. With low enough transaction costs the first-best intervention is to force drivers to internalize all social costs of travel by pricing road use to ensure efficient usage. If this is impractical, it remains useful to *reduce* road use toward efficient levels.

Pricing policies must be socially acceptable and easy to use. Direct controls on road use promote inefficiency whereas market approaches, which rely on price, select out those users with maximum willingness-to-pay. They do not restrict high-valued trips hence allowing time savings to travellers with a high value of time**.**

Pricing technologies must also be reliable and flexible enough to allow for fine-tuning and expansion as well as being compatible with other road management systems. Tolls should account for the fact that different vehicles impose different costs by measuring congestion impacts in terms of passenger car equivalents, so impacts are related to the size and weight of vehicles.

Efficient pricing, whether exact or approximate, offers a double-dividend. It improves resource allocation and can also provide a superior source of revenue for States such as Victoria that are currently dependent on, for example, regressive gambling taxes. These rely on behaviour with high social costs. Congestion taxes internalize externalities, fall heaviest upon the time-poor affluent and allow for the abolition of such socially costly taxes. In addition, it is the time-poor affluent who are often the primary beneficiaries of pricing as they live in congested and polluted inner city areas.

3.1 Comprehensive pricing. As mentioned, comprehensive first-best pricing is currently impractical for Melbourne. The potential availability, within decades, of such pricing technology allows leeway for current transport policy. Rather than

[6] Kenworthy and Laube (1999) show strong increases in the intensity of individual vehicle use to 1991 reflecting such things as increased travel distances to work. Ignoring such increases means current congestion costs are underestimated.

searching for a strategy to internalize all costs now, one can instead look for *stop-gap* strategies to contain congestion until comprehensive pricing is available. Comprehensive pricing then remains a longer-term goal.

3.2 Curbside pricing. In lieu of comprehensive road pricing some cities have introduced cheaper though less efficient pricing systems. Curbside systems monitor only major roads. They rely on interrogators located next to roads or on gantry points above roads to pick up signals from transponders or tags within passing cars. A computer analyses road usage and debits driver accounts to reflect tolls.

Unfortunately such partial pricing creates incentives for traffic to divert from priced to unpriced roads. Such 'rat running'[7], has implications for the desired scale and pricing of roads that are priced[8]. Further, if motorists change residential or other destination choices to uncharged locations, congestion itself relocates toward uncharged areas.

3.3 Cordon pricing. The priced cordon reduces congestion by charging an entry fee for access to an area, usually a city's CBD. It creates economies by monitoring along a perimeter, rather than on individual roads. The entry fee can be varied to capture marginal social costs of usage with payment made electronically by curbside charges, tollbooths or pre-purchased windscreen stickers. London has successfully introduced cordon pricing recently. The London cordon met congestion reduction targets and showed that large-scale road pricing projects can gain reasonable popularity: See Appendix 1 for discussion of the London experience.

Priced cordons are an efficient way of capturing social costs of road use because, unlike parking charges, they capture *through* as well as *terminating* traffic. To minimize adverse impacts on low-income, high travel value citizens, alternative lower-cost public transport should be made available for those unwilling to pay the cordon charge[9].

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[7] Rat running refers to touring around gantry points to avoid charges. It often creates congestion.
[8] Priced roads should have greater capacity but be priced somewhat lower: See Choe & Clarke (2000). Numerical examples by McDonald (1995) suggest substantial impacts of substitution on gains from efficient pricing. Efficient tolls may be only 25-50 per cent of levels without substitution and result in only 8 per cent of the gain were all routes priced. Given administrative costs the case for efficient pruicing can be destroyed unless such substitutions can be prevented.
[9] An elementary way of reducing congestion is to ban vehicle usage in certain areas, usually the CBD, by an un-priced cordon. These are popular in historic European cities but are a blunt control that

3.4 Information. Transport reform is politically sensitive. A prerequisite to reform is public education on the costs of congestion, the case for transport subsidies and the logic behind demand management. Such information, as a public good, will tend to be underprovided. The public must be made aware of the *rewards* from reform. The case for efficient pricing needs to be explained and distinguished from cost-recovery-based construction tolls that fund supply-side initiatives such as CityLink and the Mitcham-Frankston Tollway. Construction tolls are unpopular and inefficiently high since they target average rather than marginal costs and do not target congestion[10]. That pricing policies are not seeking revenue can be clarified by *guaranteeing* revenue neutrality by cutting other taxes when congestion charges are introduced. Harrington et al (1998) show that when authorities guaranteed that taxes collected would be offset by reduced taxes elsewhere, that support for road pricing among southern Californian residents rose 7 per cent.

Providing accurate information to the public requires up-to-date, and theoretically sound, congestion and public transport subsidy information. Much available congestion cost data is 10-13 years old, which makes it of limited use.

Taxpayers fund substantial private and public transport subsidies. The case for these subsidies is a complex one. If most industry costs are fixed as in the case of rail services then subsidies enable pricing at low levels that are close to marginal cost is efficiency-improving. With low cross price elasticities of demand for car travel however, such policies will be relatively expensive even if they have a broadly progressive effect on the distribution of income. For services involving mainly variable rather than fixed costs, subsidies create inefficiently high usage. Thus the extent of scale economies in public transport conditions price subsidy policies.

Finally, there remain political economy constraints on reform. Efficient pricing will not appeal to peripheral car-dependent areas, which are often politically-important marginal electorates. Huge public transport subsidies may likewise be difficult for

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prevents both high and low-valued trips. In Melbourne such a strategy would be costly, although blocking certain areas off to traffic does promote other sought-after city amenity attributes.

[10] This unpopularity is due to high car dependence, relatively high fuel taxes and registration fees. These tolls are inefficient if only because they are set uniformly over the day. They should be higher at peak periods if they are to reflect instantaneous marginal congestion costs.

citizens to accept. The target of education campaigns is to reduce these political barriers, thereby opening the door to efficiently pricing transport externalities[11].

3.5 Non-congestion externalities. Motor transport produces by-product as well as congestion externalities. By-product externalities include pollution, noise, vibration, accident risk and the aesthetic degradation of neighbourhoods. These costs are roughly proportional to the distance a vehicle travels and its weight, which is most conveniently related to fuel consumption. A fuel surcharge can therefore internalize such externalities. United States studies suggest such policies can double motorist private variable costs (Litman (1999, p. 3)). As discussed below in 3.7, however, such charges have a non-specific impact on congestion.

3.6 Supply-side measures. Although popular with politicians and engineers, supply-side strategies cannot, in themselves, resolve congestion problems. This is demonstrated by the persistence of congestion in large US cities, such as Los Angeles, in the face of considerable supply-side investment. While it is technically possible to increase road supplies to the point where demand never exceeds supply, this is impractical in land-scarce congested cities as it becomes increasingly difficult to scale up road capacity to keep pace with growth in travel demands. Supply measures are *at best* an expensive form of congestion relief. Their appeal stems from a free-rider externality. Individual motorists derive specific benefits from new roads but costs are borne by the *average* taxpayer. Increases in road supply have weak effects on pre-existing congestion because of 'triple convergence' issues: See Downs (1992)[12]. The only effective way of avoiding these adverse indirect effects is use of demand-side policies to make commuting less attractive.

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[11] While local residents may seek 'free-rider' benefits by leaving an isolated road such, as the Mitcham-Frankston Tollway, unpriced the point should be made that *appropriate* charges ensure efficient use of this major road rather than cost-recovery, and that the same types of charges will be applied to all other major roads. With appropriate redistribution of toll revenues all citizens in a city are then better-off with such charging. Again Harrington et al (1998) show that restricting pricing of a road to a single lane, giving a more congested alternative to those not wishing to pay a toll, increases support for road pricing by between 9-17 per cent.

[12] Downs' *fundamental law of traffic congestion* states that peak hour traffic congestion rises to meet maximum capacity because of 'triple convergence'. There is *spatial convergence,* so drivers who used alternate routes to avoid traffic switch back to routes where congestion has been reduced; *time convergence* so drivers who previously avoided peak travel switch back to travelling at closer to peak hours and *modal convergence* so drivers who previously used alternative transport modes return to cars. Increases in supply are further negated by the 'swamping' effect of increased population and increasing levels of vehicle ownership as living standards improve.

3.7 Indirect demand-side policies. If it is technically and politically difficult to directly internalize congestion costs, it is simpler to target indirect costs that surrogate for direct travel costs by levying charges on goods complementary to private car use such as fuel, registration, parking, stamp duty and spare parts. Charging for complements increases motoring costs by lowering the demand for private motorized trips. Such charges can focus on usage, and perhaps location, and should reduce vehicle fleet sizes. However this blunt approach does not specifically address congestion and creates inefficiencies by leading to under-utilization of road networks at uncongested times and places.

Indirect charges can target fuel[13] or even spare parts usage, which is roughly proportional to distance, pollution and risk. Such charges proxy for maintenance, environmental and health externalities but only marginally target congestion. These policies impose extra costs on all drivers regardless of the valuation or location of journeys resulting in inefficiently few journeys[14]. Charges can be designed so the most congested areas get charged most, but this requires large distances between congested and uncongested regions. Otherwise wasteful inefficiencies such as 'fuel fetching', namely driving to distant locations to purchase fuel, will occur. It is impractical to effectively levy such indirect charges in isolation for Melbourne.

Another approach is to level charges on a complement, such as city parking, that is related to the social costs of car travel. Parking charges can be peak-load priced to internalize social costs of peak hour travel but to not impact as much on travel at other times. However parking charges increase congestion by encouraging motorists to search for low parking fees and by increasing chauffeured and 'through' traffic.

3.8 Alternative transport. Alternatives to private road transport include walking, bicycling, or use of jitney, taxi, bus, tram or train. These alternatives often do not compete with cars in terms of speed and convenience. Cars offer space, time and route freedom and provide strong individual benefits because many of the costs they

[13] Since elasticities of car usage with respect to fuel prices are low they imply low deadweight losses. Moreover to significantly impact on external costs taxes on fuel must be low. Currently about half the cost of a litre of gasoline accrues to government as a tax or charge.

[14] Increasing spare parts costs can also undermine safety as drivers postpone repairs. Increasing fuel costs have the positive feature of inducing purchase of fuel-efficient cars.

generate are external. Attempting to reduce congestion by subsidizing alternative transport modes requires high cross price elasticities of substitution but, as these are low, subsidies need to be expensive to be effective. Subsidies themselves are 'first-best' policy prescriptions for industries dominated by large fixed costs, such as railways, but if costs are primarily variable then subsidies imply allocative inefficiencies as use then becomes inefficiently high, as discussed below.

While information on using congestion-inducing private cars to travel is a private good, information on congestion-efficient vehicles, non-motorized travel and public transport is a public good that may be under-provided. Marketing campaigns, such as the City of Perth's 'Travel Smart' program, which informs travellers of the costs associated with travel decisions, can modify transport demands by moral suasion.

If roads alone are efficiently priced, travel demands will shift toward subsidised public transport. This operates at close to full capacity at peak times, so road pricing reform calls for increased provision and hence increased subsidies. Only when *all* urban transport is efficiently priced at social marginal cost will citizens bear the correct cost of their travel choices and thereby travel and locate their residence, workplace and recreational activities efficiently. Public transport pricing must simultaneously be reformed with road pricing.

The extent to which public transport should be subsidized depends on the extent of scale economies: See Button (1993, Chapter 4). Considering public transport only, the infrastructure (rails, roads and signals) are a natural monopoly subject to scale economies but the rolling stock is not. Vehicles can be operated by relatively small, independent, unsubsidized and unregulated firms. Indeed firms can operate on the same routes, offering services that are close but not perfect substitutes. What is objectionable is not government enterprise *per se* but lack of competition. Privatized monopolies need be no more efficient than government monopolies and, indeed, efficiency can fall with only limited competition as network effects are undermined by removing central coordination. This is particularly so if strong unions remain[15]. With several suppliers, cartels form to inhibit competition. This has been the

[15] Since privatization in Melbourne, union membership has risen. See Masanauskas (2002).

liberalization experience of the Chilean and English bus services[16]. With government regulation, regulated monopolies or oligopolies merely add to the list of powerful special interest groups trying to rent-seek.

Irrespective of their efficiency, there are equity implications of subsidies. While public transport is used mainly by the less affluent, some beneficiaries of subsidies are radial commuters heading toward well-paid CBD and inner city jobs. Others less affluent tend to commute across-town to jobs in the periphery using private vehicles. If distributional impacts of subsidies are to be assessed then they must first be calibrated. Providing such information remains an unaddressed research priority.

Finally, note that some of the benefit of public transport subsidies and regulation is absorbed by declining productivity as strong unions pursue excessive wage rises and bloated management structures continue to allow inflexible working conditions and overinvestment in uneconomic services and unwarranted infrastructure. In short, special interest groups rent-seek (Mees (2000, p.86)) imposing a burden on the majority of Melbournians who rarely use public transport. The best protection against such rent-seeking is to ensure competition in these sectors.

3.9 Urban planning. Policy can seek to increase population densities in areas served by transport corridors. This reduces required travel and increases the potential for public transport patronage. However, over the next thirty years, most of Melbourne's new urban growth has been designated in the fringe districts of Melton, Casey, Wyndham, Whittlesea and Hume (Dept. Inf. (2000, p. 27)) so population densities will hardly alter given current urban design policies.

Clustering retail, employment, cultural and social institutions together in peripheral residential suburbs that are well served by public transport, can promote alternatives to the private car. However, this has not been the case with areas such as Box Hill[17], which, despite clustering commercial and social facilities and having good public

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[16] The Chilean bus service was deregulated in 1979. Bus companies quickly formed cartels to exploit the Government's absence from the market, service levels deteriorated, prices increased and traffic congestion dramatically increased. The only beneficiaries were the cartels. The English bus service suffered a less severe fate than the Chilean, when it was deregulated. Service levels decreased and prices increased leading to increased traffic congestion. See Mees (2000, 108-116).

[17] Box Hill is one of Melbourne's largest employment centres, with 15,000 workers. It is well serviced by bus and train but only 7 per cent of its workers arrive on public transport (Cervero (1998, p. 328)).

transport, remain dominated by car use. Moreover, creating large commercial developments in residential suburbs, to reduce traffic pressures, can encounter local community opposition as public protests on developments in the Camberwell[18] Station area highlight.

3.10 Traffic calming and other policies. Traffic calming involves slowing down traffic to make streets safer and more useful for pedestrians, cyclists and general residential life. This is achieved by altering road widths, reducing speed limits, building chicanes, neck-downs, speed plateaus and bumps, and by encouraging cautious, slower driving. As well as adding street furniture and vegetation to make the environment visually attractive and less car-oriented, traffic calming reduces external costs of car use and accidents. Importantly, by increasing the user costs faced by motorists, traffic calming reduces local traffic flows and limits spill-overs onto local roads from the pricing of major roads alone.

Other policies include *ride-sharing* which reduces congestion provided people are induced not to drive alone. This requires common origins, destinations and travel times. High occupancy vehicle lanes encourage ride-sharing but also restrict supply, increasing congestion.

Introducing greater *flexibility in working hours* reduces travel demands during peak periods but also reduces the coordination benefits that arise from synchronisation of work hours. Triple convergence will offset all but the most extreme flexi-time strategies and such strategies would need to be organized city-wide to significantly reduce congestion. One practical way of re-organizing times to reduce congestion is to alter public school hours to allow chauffeured trips to schools to be carried out further from peak times.

Park- and- ride facilities allow travellers to drive to public transport, park and then transfer to public transport. Melbourne already exploits park- and- ride, with over 23,000 car spaces provided near stations in addition to on-street parking (Mees (2000, p. 231)).

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[18] State Government proposals to develop Camberwell as a centre have led to significant public protest.

Finally, *upgrading accident and disabled vehicle procedures* by using roving recovery vehicles can reduce accident-induced congestion delays.

4. Melbourne: CBD and Radial Traffic Reforms

The most intense congestion in Melbourne occurs on radial arterial and central roads. This should be addressed by curbside and cordon pricing respectively. Such policies are simple and user-friendly with electronic monitoring allowing tolls to be levied at low cost. These policies do not interfere with traffic flows and pricing can be varied to reflect short-run social costs. While impacts are concentrated on high-income, high time valuation city-based workers, adverse distributional impacts, where they do occur, can be negated using compensations from toll revenues. Indirect demand-side strategies, such as traffic calming, can be used to minimize boundary problems.

4.1 Radial arterial pricing. Melbourne's radial arterials spread from the centre of the city like spokes on a wheel. They are intended to provide high speed uninterrupted access to the city from the periphery[19] but experience congestion during peak periods. Arterials are suited to curbside pricing since their high traffic volumes justify transaction costs involved and alternative roads are, or can be managed to be, imperfect substitutes for free-flowing arterials. The limited number of entry and exit points minimizes the number of costly gantries required for monitoring. Indeed arterials would only require about ten gantry points[20], many of which could be strung from bridges.

The CityLink road network is the only free-flowing axis linking the South-Eastern Freeway, West Gate Freeway, Tullamarine Freeway and Melbourne's ports. It is an important arterial but is inefficiently priced with excessively high tolls leading to low patronage and excessive congestion on neighbouring substitute roads. Given CityLink's importance for cross-town travel its contract should be renegotiated to protect its revenues while modifying its tolling to reflect short-term marginal social costs.

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[19] The radial arterials include the Eastern Freeway, South-Eastern Freeway, Calder Freeway, West Gate Freeway, Princess Freeway, Western Freeway, Tullamarine Freeway, Hume Freeway and CityLink.
[20] The number of entry/exit points on Melbourne freeways is approximately ten.

Melbourne already has experience with the technology, management processes and enforcement required to implement road pricing, via CityLink. This technology has a 99.9 per cent capture rate, needs little space and causes low environmental impact. It has low fixed staff costs and low marginal costs. Gantry points, though expensive, can be minimized because of the limited number of entry/exit points: see **Table 1** below. Melbourne residents are familiar with this technology. Many residents already own an E-tag and scope exists to create economies of scale in road pricing management by outsourcing management of new arterial roads to firms such as CityLink.

Melbourne's arterials face some competition from unpriced alternate routes and so need to be priced lower than they would without competition. Drivers can be discouraged from 'rat running' around tolled roads by using traffic calming to inhibit journeys through neighbouring roads. Such policies have been successful in London. Traffic calming imposes extra costs upon local journeys and encourages walking and cycling.

Table 1: Arterial and Cross-Town Roads that can be Priced in Melbourne

Existing Roads with construction tolls	**Approximate number of entry/exits**[21]
Monash Freeway	15
Link Road	8
Bateman Avenue	2
Burnley Tunnel and Grant Street	2
Mitcham-Frankston	Not built
Roads not yet tolled	**Approximate number of entry/exits**
Eastern Freeway	10
Western and Eastern Ring Roads	17
West Gate Freeway	7
Tullamarine	10
Calder	9

4.2 Cordon pricing. Cordon pricing operates with the same logic and technology as curbside systems but has the advantage of offering economies by monitoring road use only at the periphery of an area rather than monitoring each individual road within an area. The RACV advocates cordon pricing in Melbourne (Birnbauer (2002)).

Melbourne's cordon should cover Melbourne's CBD up to, but not including, Victoria St, then diverting down Clarendon St and Hotham St, running down Punt Rd, down

[21] The exact number of entry/exit points depends on how points are clustered together and on how far out from the CBD one goes. The distances selected here reflect levels where congestion problems arise.

Alexander Ave to Anderson St, Domain Rd, across St Kilda Rd to Park St, then down Kings Way, Sturt St, Power St and along Clarendon/ Spencer St, up Dudley St around the inside of Victoria market and returning to Victoria St. Areas such as the Crown Casino car parks should lie inside the cordon to prevent motorists parking in such areas and walking in creating an accumulation of congestion on the cordon boundary. An impressionist view of the cordon structure is drawn below in **Figure 1**. This cordon design captures most of the congested core and is small enough to require only about twenty gantry points which would keep start-up costs well below London's £200 million cordon, with its over 200 entry and exit points.

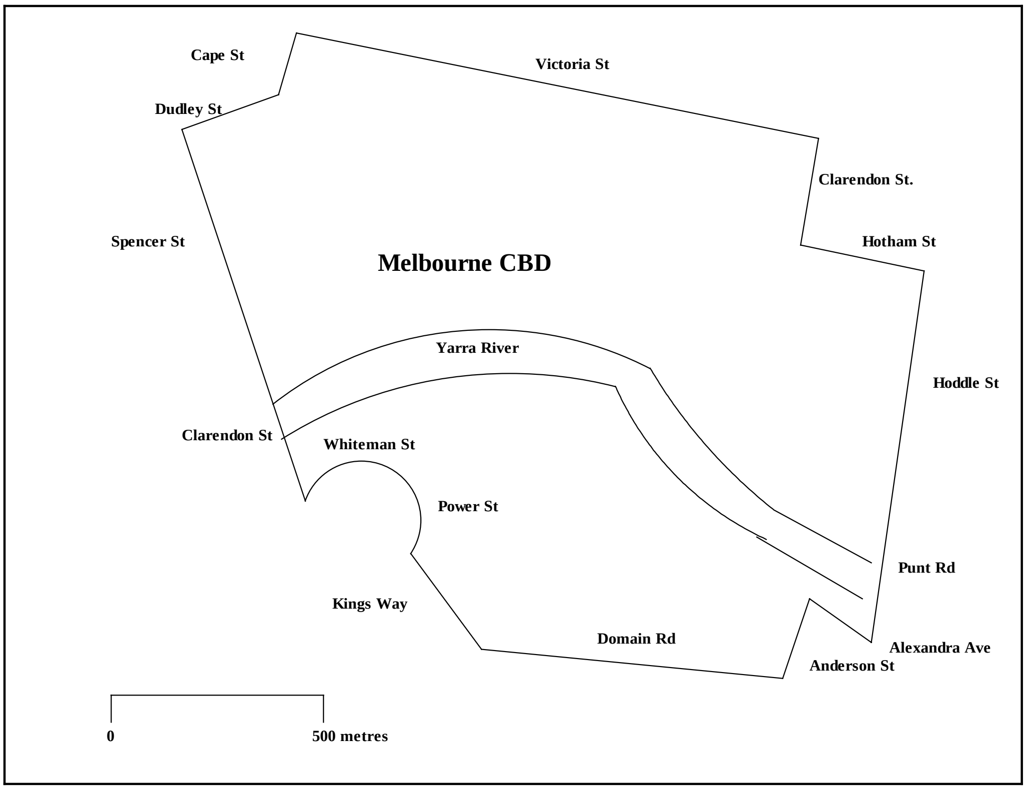

Figure 1: The Proposed Inner City Periphery Cordon

Through traffic can bypass the cordon by running around the perimeter roads or by using CityLink. Public hospitals, schools, and most emergency services would remain on the periphery of a small cordon, thus reducing claims for exemptions from charging. The cordon also excludes the entertainment and restaurant precincts of Lygon St, Brunswick St, Victoria St, Toorak Rd, Swan St and Docklands as well as the shopping precinct of Victoria Market. The cordon is far enough away from the

CBD so that workers should be deterred from parking on its boundary and then walking in. Boundary problems are further minimized by positioning the periphery within commercial and industrial areas that have significant parking restrictions and rigorous enforcement.

Because Melbourne's centre also has tight parking restrictions it does not need to adopt an *area cordon*, like London, where cars are billed merely for being on city roads. Rigorous enforcement of parking restrictions allows Melbourne to operate a *periphery cordon*, in which drivers are only charged for *crossing* the cordon boundary. This helps internalize the social costs of trips out of, as well as of multiple trips across, the cordon and thus better reflects social costs of using roads. As no substitute roads exist, the cordon charge can accurately reflect marginal external cost of using city roads. The charge should vary to reflect the social cost of road use depending on time, day, week and vehicle type allowing a more efficient allocation than London's single price.

Unlike London, Melbourne should not exempt taxis, motorcycles, mopeds, buses, recovery vehicles, repair vehicles and alternative fuel vehicles, as all contribute to congestion. All vehicles should pay for the external costs they inflict. Motorcycles, mopeds and alternate fuel vehicles impose lower costs and this should be reflected in their charges. Taxis and buses do impose congestion and tolls levied should reflect this. The cordon charges would internalize the external costs associated with using city roads leaving parking charges directed to capture the additional specific costs of parking.

4.3 Public transport. In Melbourne more than 76 per cent of the employed travel to work by car. Less than 13 per cent travel to work by public transport and most of this is within 8 kilometres of the city centre in an area intensively serviced by train and tram (ABS (2003)). To effectively manage shifts of demands from radial travel to public transport following road pricing, public transport must be efficiently priced. One approach is for Government to withdraw from unnecessary interventions in public transport and to limit itself to the provision of infrastructure, the rails, roads and signals, which are natural monopolies. It then only charges operators of the rolling stock the marginal cost of using infrastructure with policy focusing on ensuring safety standards and preventing anti-competitive behaviour.

Private transport monopolies should be broken into independent firms and barriers to entry in the respective various markets removed. Radial public transport can be composed of private trains, trams, buses, jitneys and taxis, all offering substitute services. Firms should be free to decide which routes to service and service frequencies, prices charged, ticketing systems used and service quality offered. Market forces would reduce costs, encourage wage discipline and reward good management[22].

5. Melbourne: Cross-town Traffic Strategies

Improving the efficiency of cross-town travel in Melbourne is a difficult challenge. The economies of scale that allow direct demand-side strategies for radial travel and within the CBD rarely exist in the sprawling plethora of cross-town roads. Yet some of the worst congestion occurs on cross-town roads such as Springvale Road. This is 20 kilometres from the city centre and provides the main north-south road link in Melbourne's Eastern suburbs[23].

Public transport infrastructure is primarily radial as population densities necessary for mass transit are not available for cross-town journeys in the periphery. Land-acquisition costs limit the potential for supply-side measures there so policies are limited to indirect demand-side tactics and occasionally, when traffic volumes permit, to direct demand-side measures.

5.1 Roads. Melbourne's cross-town roads generally do not run the length of the city; they have relatively low capacity, and are frequently interrupted by intersections. The only arterial road in Melbourne that currently allows uninterrupted cross-town travel is the Western Ring Road, a recent addition to the network. A significant expansion of cross-town road supply is impractical given land acquisition costs involved.

Cross-town roads are not suited to *direct* demand-side strategies. Their price elasticity of demand is low, as close substitutes exist for each road. In addition, because the

[22] This argument broadly follows Winston & Shirley (1998).

[23] A survey of 7,500 RACV members described the intersection of Springvale Rd and Whitehorse Rd as the worst traffic congestion in Melbourne. In part the poor reputation of this area is that motorists do not expect such congestion at such a distance from the CBD. Five other outer metropolitan sites were described as the most congested in Melbourne. See http://www.racv.com.au/road/redspot/redspot.asp.

roads are perpetually interrupted by entry/exit points, the number of gantry points required would either prove expensive, if comprehensive monitoring was attempted, or lead to ‘rat running’ induced congestion toward un-priced roads if it was not. Road capacities are low with few roads having more than four lanes, so the scale required for viable road pricing is not present.

The Western Ring road and the soon to be constructed Mitcham-Frankston tollway are the only cross-town roads with sufficiently high patronage and with the limited number of entry/exit points required to enable curbside pricing. Charges should be set below first-best levels since some substitute routes do exist.

While cross-town travel can never be as efficiently managed as radial travel, it has the advantage of imposing relatively lower congestion. Cross-town commuters on average are less affluent and have lower incomes than inner city workers. The cost implications of congestion for them should therefore be lower than the city workers.

With comprehensive road pricing decisions about expanding existing roads and building new roads can be made in a more informed way. If road segments remain congested despite high pricing – in short, when they are earning good profits after accounting fort all costs associated with their operation – there are strong grounds for expanding them.

5.2 Integrated urban and transportation planning. An urban growth boundary can be used to limit Melbourne’s urban expansion to, in turn, limit transport problems in the city periphery. Restricting expansion halts encroachment into fringe wilderness, agricultural land and public amenity areas. It also encourages the development of viable satellite cities and regional cities as a substitute for urban sprawl. By increasing population densities, public transport and ride-sharing become increasingly viable in the periphery.

Unfortunately most population growth has occurred[24] and is forecast to continue to occur on city fringes where it will be channelled into ‘growth corridors’ (Dept.

[24] Between the 1996 and 2001 censuses Melbourne’s population grew more than 7 per cent. More than half of this reflects residential growth in outer and fringe suburbs such as Caroline Springs in the West, Roxburgh Park in the north and Narre Warren South in the south-east. Only about 12 per cent has occurred in the local government areas of Melbourne and Port Phillip: See ABS (2003).

Infrastructure (2000, p.27)). The State Government then sees these corridors being serviced by radial transport in its Melbourne 2030 policy document. Since travel in fringe suburbs is primarily cross-town this strategy is likely to be ineffective.

The only suburbs in Melbourne with a transit-oriented public transport system are the inner suburbs. Transit-oriented public transport allows for quality travel in all directions at virtually all times, as opposed to commuter public transport which only allows for efficient radial commuting at peak hour: see Mees (2000). Internal growth boundaries need to be developed to restrict high-density housing to transit-friendly locations within the inner and surrounding suburbs. Reducing building and heritage regulations in these suburbs would allow greater numbers of people to live closer to areas of high employment and increase the proportion of the population with access to transit-oriented public transport.

Developing new suburbs with schools, shops and required social infrastructure can reduce travel demands in the periphery. This suite of policies is a component of the Melbourne 2030 planning strategy (Dept. Infra (2002)).

5.3 School hours. A reform that would improve traffic flows is to shift school opening hours from peak periods. Most schools in Melbourne remain closed to students until around 8:30am. Private transport then remains the preferred means for those parents who drive their children to school to get to work by 9:00am. If public school hours could be rescheduled to commence an hour earlier and finish one hour earlier this would make public transport a more feasible option for parents trying to get to work on time. It would also allow children to travel before the height of the peak period.

Adolescents travelling cross-town have access only to slow, inconvenient and expensive public transport and often rely on parents to chauffeur them. Relaxing age restrictions on the driving of mopeds would reduce congestion but raise potential road safety issues.

5.4 Public transport. The sole comprehensive cross-town public transport mode in Melbourne is the tram network which, except for a few offshoots, is restricted to inner suburbs. Cross-town bus services are sporadic, slow, indirect, inconvenient, poorly timetabled and expensive for the service they offer. Government subsidies and regulation have failed to deliver a public transport system that efficiently services cross-town journeys in the periphery.

Government regulated monopolies face information problems in attempting to cope with the dispersed times, points of departure and destination characteristic of cross-town travel. There is not enough 'mass' to make mass transit work (Mees (2000, p. 39)) so more specialised and diverse transport services are needed. Given these information issues, unregulated markets may offer superior outcomes and better coordination than central planning. Numerous unsubsidized and largely unregulated firms with access to common infrastructure may offer a superior solution to the dispersed travel requirements of cross-town travellers. Trams, buses, jitneys and taxis could provide substitute services[25]. Competition would keep prices at marginal cost while market forces limit over-supply and encourage quality service. Market forces would encourage wage discipline, reward good management, creativity, improved customer service and product differentiation.

Government could again focus on providing infrastructure, preventing anti-competitive behaviour and ensuring safety standards.

6. Final Remarks. Traffic congestion in Melbourne is a consequence of inefficiently priced transport services which leads to inefficiently high traffic demands. Indeed little attempt has been made to even collect and collate timely data on the marginal costs of congestion or the changes required to drive road use toward its designed capacity. A crucial component of any research strategy should be provision of this data. Research should also address the distributional implications of alternative transport pricing regimes and the issue of scale economies in public transport provision.

Melbourne has consistently favoured supply-side solutions that are theoretically unsound and which impose costs on all taxpayers regardless of their travel decisions. Despite this, supply-side strategies have electoral appeal. Consumers are largely unaware of the scale of the non-internalised travel costs and of the case for

[25] The Queens Van Plan operates in New York's poor areas unserviced by public transport. It receives no subsidies. It charges patrons a flat $1 fee per ride: See Winston and Shirley (1998).

subsidisation of well-managed transport businesses that operate with economies of scale. Thus a second urgent policy priority is to organise a comprehensive education campaign highlighting the benefits of demand-side strategies. This would help to gain public acceptance for the demand policies required for a fairer, more effective transport system.

The first-best solution to reduce traffic to socially efficient levels is comprehensive road pricing coupled with marginal cost pricing of all public transport. This is currently infeasible, due to the start-up costs of road pricing but should be a long-term objective.

Cost improvements will stem from adopting a suite of direct and indirect demand-side strategies. By-product externalities should be internalized through the continued use of externality taxes on fuel, and variable registration and insurance charges. Arterial and CBD roads should be priced. Pre-setting urban boundaries would increase population density while internal growth boundaries would focus development, reduce travel, and increase numbers of people with convenient access to public transport. Public transport must be priced at closer to efficient levels to encourage efficient modal substitutions.

A suite of direct and indirect demand-side strategies would be more efficient and fair in reducing traffic congestion than the current system of traffic management in Melbourne.

Appendix 1: London's Cordon Pricing Scheme. London's population is twice that of Melbourne although it is 25 per cent smaller in area. Like Melbournians, Londoners prefer living in residential suburbs, segregated from industry and therefore have high car-dependence. Like Melbourne too, most jobs, retail, entertainment and educational institutions are located in central and inner suburbs while most people live in the periphery. Thus most journeys are radially directed to or from the city[26]. Unlike Melbourne high costs of fuel, road congestion, parking and the availability of an extensive public transport system, make public transport the preferred mode of travel, accounting for 84 per cent of trips to central London (AA (n.d) p.3).

[26] 1.28 million people visit central London each day (Mayor's Transport Strategy (2001, p. 2.21)).

Nevertheless, London has suffered all-day congestion, with drivers spending long periods in traffic jams and with peak periods approaching gridlock. Estimated congestion costs were £2 billion per year with residents also suffering health and aesthetic costs due to some of the worst quality air in Europe (Mayor's Transport Strategy (2003)). Demand-side congestion reduction tactics, such as parking restrictions and high fuel taxes, have failed to curb congestion.

London's public transport consists of an Underground Rail, National Rail and bus services. The quality of this system has deteriorated over recent decades due to public expenditure restrictions. The network has developed a reputation for poor punctuality and for being uncomfortable and unsafe. High fares exacerbated the problem. Buses, primarily responsible for cross-town journeys, have experienced declining productivity due to congestion, funding cuts and mismanagement.

On 17th February 2003 London implemented cordon pricing to rejuvenate its failing transport system. The cordon covers central London including the centres of government, business, finance and entertainment. Its perimeter is formed by the Inner Ring Road, use of which is uncharged. The cordon is designed to reduce traffic entering central London and on the radial arterials, while improving the efficiency of road-based public transport. By reducing traffic overall congestion was predicted to fall 20-30 per cent.

London has opted for an *area cordon* so vehicles parked on the street within the cordon are liable for a charge, regardless of whether they cross its perimeter. This is done because much congestion is caused by illegal parking. The cordon is electronically monitored using video stream and automatic number plate recognition to view automobiles (Commission for Integrated Transport (2003)).

While start up costs of £200 million (Winkley (2003) the cordon was expected to generate substantial future net revenues to be reinvested in public transport. Reduced congestion and other transport benefits from charging were estimated at £180 million per year against costs of £130 million. The normal cordon toll is £5 giving all day access between 7:00am and 6:30pm on weekdays. Hefty fines and penalties are levied on non-payers. Exemptions from tolls are made for taxis, motorcycles, mopeds, buses, emergency vehicles, alternative fuel vehicles, health service and vehicles driven by the disabled and there is a ninety per cent discount for residents (TFL (2003)).

The cordon has significantly reduced vehicle numbers entering central London. It has reduced congestion, increased travel speeds and travel time reliability. Overall traffic flows within the cordon have fallen 10-15 per cent with journey times across the cordon down 14 per cent. Journey times and traffic speeds in central London have shown small improvements and traffic delays have fallen thirty per cent. Journey time reliability has increased by thirty per cent. Average speeds on roads in the cordon have increased from 14.3 to 16.7 kilometres per hour (TFL (2003)).

Only 4,000 people per day have stopped coming into the city area because of the cordon. Of those not entering the cordon 20-30 per cent have diverted around the cordon; 50-60 per cent have transferred to public transport; 15-25 per cent have switched to carpooling, bicycle, motorcycle, travel outside of hours or are not making trips. There has been no substantial shift in the timing of journeys (TFL (2003)).

Outside the cordon there has been a small reduction in congestion on the Inner Ring Road. Radial roads immediately outside the inner ring road have had significant reductions in congestion (TFL (2003, p 3.31)). On outer arterial roads there has been no noticeable change (TFL (2003)).

Average commuting times from outer London to the cordon have fallen from 46 to 40 minutes (Planning, 30/5/2003. p6). There has been no significant traffic displacement to local roads around the cordon (TFL, 2003b, p.3.52) due to £100 million spent on ‘traffic calming’ boundary roads (Planning, 17/1/2003, p.9).

Revenues are lower than expected as vehicle numbers entering the cordon are lower than anticipated and levels of attempted evasion much higher.

London has spent the revenue generated by the cordon on upgrading the public transport system. The bus network has been the primary beneficiary of both reduced road traffic and extra revenue from fares. Three hundred extra buses have been added (RTPI, 30/5/2003, p.6) and the number of seats available has increased by 11,000 due to higher frequency trips, new and altered routes and larger buses (TFL (2003, p.3.70)). Bus delays due to traffic inside the cordon have reduced by 50 per cent

(Planning 30/5/2003, p.6)). Excess waiting times for buses have reduced by over a third on routes servicing the cordon area (TFL, 2003, p.1.11).

Overall the London experience of using cordon pricing has been successful.

Appendix 2: Melbourne’s Priced Roads

Melbourne’s has or will have two types of priced roads: The CityLink tolled roads that operate as a radial link from the North and from the East to Melbourne’s city centre and the proposed cross-town road, the Mitcham-Frankston Project that links the Eastern Freeway in Donvale to the Frankston Freeway near Seaford. Neither of these two projects is effectively congestion priced. Pricing is based on a ‘user pays’ principle which recovers project costs and yields a return to the private sector operator. There is a case for renegotiating the agreements the State Government of Victoria has with the operators of these projects.

CityLink Roads. Transurban was given the concession to operate these roads in 1996. The concession was generous with the project costing $1.8 billion to build and shareholder equity in the operation now amounting to $5 billion. Revenues are of the order of $250 million which would have been sufficient to support $6 billion of investment which exceeds the cost of both the CityLink and the Mitcham-Frankston projects by $1.5 billion. Tolls are claimed to be at least twice the level required to recover the cost of a publicly-funded tollway: See Davidson (2005). The traffic catchment area for the project covers about half of Melbourne. Transurban is entitled to compensation if future Victorian Governments develop plans to improve alternative forms of transport that would divert revenue from CityLink.

Tolls currently depend on where motorists enter and where they exit CityLink as well as on the type of vehicle used (car, light commercial (LCV), or heavy commercial (HCV)). In the main however charges are independent of the extent of congestion on the roads. A 24 hour day pass ranges from $9-95 for a car to $18-95 for a HCV. The maximum charge on either section of the road is $5-20 for a car and $6-95 for a HCV during day hours discounted to $5-20 between 8pm and 6am. That higher charges are levied for larger vehicles and that a discount is offered to LCVs and HCVs overnight is consistent with the spirit of the congestion pricing philosophy but these effects are modest. Overall charges are congestion-independent. There are substantial 'boundary problems' reflecting the accumulation of congestion externalities in areas such as Essendon adjacent to CityLink as motorists divert around the tolled road. These problems would be reduced with congestion-pricing and thus more even traffic flows.

Mitcham-Frankston Road. The concession to operate this project was awarded to the ConnectEast Group led by Macquarie Bank, Thiess Pty Ltd and John Holland Pty Ltd. Thiess and John Holland are responsible for design and construction. The project comprises 39 km of toll road including 1.5 km of tunnels. It will be a fully electronic tollroad using short-range microwave transponder tags and advanced video camera technology. The tags will also operate on CityLink. The project is forecast to cost $2.5 billion and is scheduled to open in late 2008. .

Unlike CityLink the Mitcham-Frankston prospectus states there are no restrictions on government upgrades to competing roads and public transport. Davidson (2005) has suggested that government should upgrade bus services in the area and replace urban level crossings with grade separations along the Ringwood Railway line to allow roads such as Stud Road to compete more effectively with the proposed tollway. This would reduce the market value of the Mitcham-Frankston Road and permit a public buyback of the tollway at reasonable prices as suggested by the Victorian Branch of the Liberal Party.

As it stands the maximum toll set will be $4-43 for cars (in 2004 dollars) with neighbourhood and weekend discounts for cars. While the proposal does not involve congestion pricing, tolls are low enough to minimise boundary problems on substitute routes such as Springvale and Blackburn Roads. With congestion pricing there would be low induced congestion on these congested substitute roads. Indeed traffic pressure on these roads should substantially fall.

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