Garnaut Climate Change Review:
Transport, Planning and the Built Environment

Submission

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GAMUT

Australasian Centre for Governance and Management of Urban Transport

Preamble

GAMUT Welcomes the Garnaut Climate Change Review Initiative

At the Australasian Centre for the Governance and Management of Urban Transport (GAMUT) we welcome and support the government's initiative in seeking to consider, through the independent review process of the Garnaut Climate Change Review (hereafter GCCR) the need for climate change mitigation strategies across all industry sectors.

We consider an appropriate response to climate change to be a high priority for the transport system and we wish to express our gratitude at being given the opportunity to participate in this community consultation process.

Climate change is of central importance to the mission of GAMUT, which is to conduct research into the governance and management of urban transport with the overall goal of reducing the environmental and social costs of these systems through reforms to governance, institutions, policies, and practices.[1]

This submission covers the GCCR transport, and to a lesser extent, planning themes; it does not address the built environment sector other than where these issues pertain to transport and planning.

Most of the national discussions on climate change proceed on the basis of established policy settings, and while being practical, this approach has led to an unnoticed narrowing of the policy debate. In this submission, we wish to highlight some of the limitations of these established orthodoxies. Even the GCCR has cast many issues into the framework and language of economics and while this has an obvious appeal to the nation's and state's political leaders, we are concerned that this orientation can skew the national debate over climate change, act to exclude a range of social actors, and privilege a narrow set of values and interests.

Response to the GCCR Terms of Reference

While the Review's TOR explicitly calls for the development of market-based approaches, preparation of the national response to global warming cannot proceed exclusively on such a narrow base. Arguments for bringing market signals and principles more strongly into the climate change response may have merit, but need to be tempered by the acknowledgement that there are considerable 'market failures' in place, notably persistent externalities, inadequate information for economic decision-makers, non-market barriers to change, and risks not captured within markets.

Accordingly, GAMUT offers this submission with an emphasis on issues of governance, and recognition of the importance of protecting and supporting social and environmental values. Further, while climate change calls for policy interventions and government, corporate, and community actions across many spheres of activity, in this submission GAMUT highlights what it considers to be issues of high strategic priority.

There is considerable scope to the GCCR Terms of Reference (TOR) and indeed, it seems as if the Review has been set a near-impossible task, given the complexity of these issues. This is not an appropriate vehicle to discuss these TOR, but GAMUT would hope that through the on-going response to the Review, there will be wider consideration of the neglected aspects of the climate change issue. In this submission, we confine our attention to those matters within the Review's TOR of highest priority to GAMUT's activities. We will not be discussing the potential impacts of climate change on transport, planning, and built environment (TOR #1) or adaptation to climate change by these sectors (within TOR #2), but will cover aspects of the other TOR.

Scope of the GAMUT Submission

In this submission, for reasons of brevity, GAMUT offers an overview of key issues but without the full documentary and evidence support of the available research and

[1] GAMUT's mission and activities are described on its website at: www.gamutcentre.org.au

scholarship in these fields. If requested, we would be able to provide an account of this research and scholarship.

Introduction

Australia's Future GHG Emission Reduction Targets and Timetables

GAMUT endorses the views expressed in the GCCR *Interim Report* as framing the essential problem in climate change policy formulation, namely: "Australia must put in place effective policies to achieve major reductions in emissions".[2] Further, the *Interim Report* calls for "firm commitments in 2008, to 2020 and 2050 emissions targets" and suggests that while 60% targets by 2050 would be appropriate for matching the efforts of other developed nations, "Australia would need to go considerably further in reduction of emissions as part of an effective global agreement, with full participation of developing countries, designed to reduce the risks of dangerous climate change to acceptable levels."[3] As stated by the *Interim Report*, if Australia were to adopt the 'contract and converge' principle of equitable per capita GHG emission targets for atmospheric GHG stabilisation of between 450—550 ppmv CO_2-e, its emissions would have to fall by 70% below the 1990 baseline by 2050.[4] It has already been observed by some scientists (including Dr. James Hansen, head of the Goddard Institute of Space Studies in New York) that the 'safe' target would be nearer to 350 ppmv CO_2-e.

To the issue of national emission reduction targets can be added the sectoral allocations. Australia has not explicitly pursued a policy of an equal allocation of emissions between the nominated economic sectors (as dictated by the FCCC national GHG inventory reporting), although this is often assumed in policy discussions. There is a case, therefore, for adding to the climate change debate the issue of setting sectoral targets.

Urban transport as at present constituted in developed world cities is unsustainable.[5] Urban transport is profoundly dependent on the combustion of fossil fuels, particularly petrol and diesel, and to a lesser degree petroleum gas. The environmental costs of carbon-based transport to its users have up to now been near zero. Placing a cap on carbon emissions, reducing over time, and trading permits under this cap will put a price on at least one of those environmental costs: the cost of atmospheric instability. Unless the suppliers of transport can provide an adaptive response at the same pace as the rising price of emissions, the result will be a large increase in the price of physical mobility for persons and freight in cities. The price increase will flow on to individuals and businesses.

For those who can't afford to pay it will mean a serious loss of mobility. The value of accessibility (which may mean simple proximity) to jobs and services will greatly increase. Residential locations physically close to urban services such as schools, health services, recreational facilities, and shopping centres will increase in value, while those distant from such services will fall in value. There will be a major transfer of wealth from outer to inner and middle regions of cities, and from public transport rich to public transport poor areas, dividing cities between outer slums and inner 'gold-coasts'.

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[2] Gaurnet Climate Change Review (2008). *Interim Report Interim Report to the Commonwealth, State and Territory Governments of Australia:* page 5.

[3] Ibid: page 5.

[4] Ibid: page 39.

[5] See, e.g., Akerman J. and Hojer M. (2006). How much transport can the climate stand?—Sweden on a sustainable path in 2050. *Energy Policy*, Vol. 34: 1944--1957; Banister D. (2005). *Unsustainable Transport: City Transport in the New Century*. Routledge: London and New York; Litman, T. (1999), *Reinventing Transportation: Exploring the Paradigm Shift Needed to Reconcile Transportation and Sustainability Objectives*. Victoria Transport Policy Institute: Canada; Newman P. and Kenworthy, J. (1999). *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press: Washington DC.

The UK Stern report states that: "Transport is one of the more expensive sectors to cut emissions from because the low carbon technologies tend to be expensive and the welfare costs of reducing demand for travel are high."[6] However, a recent report by McKinsey and Co. argues that several transport changes are cost negative to the economy. The major impacts are likely to be distributional.[7]

An adaptive response to the developing situation under an ETS is not just one to be handled by market transactions amongst multiple actors. Government is directly involved in four fields:

- In leading investment in transport infrastructure
- In planning and managing systems of collective transport
- In establishing and supporting fiscal regimes relating to transport (the taxation of and subsidy for different transport modes), and
- In the regulation of land use.

These government policy fields impinge seriously on the choices available at the level of the individual. However — and whatever target is set for transport emissions reduction — on simple pragmatic grounds, no significant national target is possible without a significant contribution from the transport sector, and that requires a rapid adjustment of government policies.

Nothing can be done about the nation's past decisions on climate change, but these can certainly form some important 'lessons from history'. Australia has had a national strategy on climate change since that produced by the Council of Australian Governments in 1992, yet in 2008 there remains almost no discernable change in the fundamental composition, directions, and activities of the Australian transport sector to take into account that the sector is a major source of the nation's GHG emissions (around 17%). Australia's national target for GHG emissions reduction was established in the Kyoto Protocol negotiations in 1996 and since that year, transport emissions have risen continuously. Australians and indeed, the global environment, must now bear the opportunity costs of the foregone opportunities to take meaningful action in reducing emissions over this period when the nation had already acknowledged at the highest levels that such action was necessary and unavoidable. During this time, Australia's major cities have invested heavily in road transport infrastructure that has promoted increased GHG emissions.

Prof. Garnaut correctly observes: "The acceleration of economic growth would be an unambiguously good thing if it were not for the inconvenient truth that the scaling up of the patterns of life of the developed countries to the populous parts of the world is not sustainable without major changes in the relationship between economic activity and the environment. The inconvenient truth has its origins in the dependence of modern economic growth on the utilization of fossil fuels, especially in the energy and transport sectors."[8]

GHG emissions from the transport sector constitute a major issue in climate change:

- Australia has yet to demonstrate an ability to curb the growth of transport emissions
- Trends in transport emissions are for increasing GHG emissions under Business-as-Usual scenarios
- International experience has demonstrated that transport emissions have proved very difficult to curb, yet there exists a wide range of transport systems

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[6] Stern, N. (2007). *The Economics of Climate Change: The Stern Review.* Cambridge University Press: Cambridge: Annex 7c.

[7] McKinsey and Company (2008). *An Australian Cost Curve for Greenhouse Gas Reduction*. Available online at: http://www.mckinsey.com/clientservice/ccsi/pdf/Australian_Cost_Curve_for_GHG_Reduction.pdf

[8] Garnaut, R. (2007). 'Will Climate Change Bring an End to the Platinum Age?' Inaugural S.T. Lee Lecture on Asia and the Pacific 29 November 2007. Available online at: www.garnautreview.org.au/

internationally with varying overall GHG emissions (including 'best practice' examples)
- There are many components to the transport sector: passenger, freight, air and shipping, but GHG emissions are dominated by one sector: road vehicle use in the major cities, and
- We face the prospect of a transport system that meets the needs for urban mobility using only a fraction of the amount of fossil fuels consumed at present, something unprecedented in the contemporary era.

The success or otherwise of these goals to improve the environmental and social performance of the transport system will, in GAMUT's view, depend to a substantial degree on matters of governance and political decision-making.

Therefore, in our submission we offer that:

- There is great urgency to reduce GHG emissions.
- Within the coming decades great efforts are required to significantly reduce transport GHG emissions.
- Considerable emissions reductions from urban transport can be achieved in the short-term.
- There is adequate knowledge and experience to achieve these reductions within this timeframe.
- An effective strategic approach to addressing GHG transport emissions requires maximising the rapid application of known, available, and feasible policy options[9]
- Transport GHG emissions can be reduced in the short-term using non-market measures.
- Market-based policies will not be effective for transport GHG emissions reductions in the foreseeable future, and
- Good governance is the key to reducing transport GHG emissions.

In Part A we identify key problems with the transport sector that give rise to the aforementioned issues, followed by Part B which offers a set of resolutions.

Part A. Diagnosis

A1. Poor Prospects for Short-Term GHG Emissions Reduction through Vehicular Technologies

GAMUT submits that the prospects for reducing transport GHG emissions through improvements to vehicle technologies in the short term are very poor (with only the commercially ready or near-ready electric-petrol hybrid vehicles likely to have any significant influence).

Technology strategies for reducing vehicular GHG emissions are well known and a number of reviews are available.[10] In this realm, Australia is principally a recipient of technological innovations as the domestic capacities and available resources for research and development are small in comparison to the task involved and the major investors in vehicular research are based overseas.

Several alternative fuel options are available or under development and these have received considerable interest from public policy decision-makers and the general public. However, none of the available and mature alternative fuels offer substantial GHG

[9] Moriarty, P. and Honnery, D. (In press). Mitigating greenhouse: Limited time, limited options. *Energy Policy*.

[10] See, e.g., Moriarty, P. and Honnery, D. (In press). The prospects for global green car mobility. *Journal of Cleaner Production*; Moriarty, P. and Honnery, D. (2004). Forecasting world transport in the year 2050. International *Journal of Vehicle Design,* Vol. 35 (1/2): 151—165; Moriarty, P. and Honnery, D. (2004). Forecasting world transport in the year 2050. *International Journal of Environment and Pollution,* Vol. 30 (1): 8—26.

reductions over conventional fuel sources.[11] Alternative fuels are at best a marginal improvement and not the basis for a revised energy system that offers a low-carbon source for future urban mobility.

Biofuels, such as ethanol, do not offer significantly lower GHG emission rates than conventional fuels.[12] When biofuels are produced from by-products of agricultural and industrial processes, then there is a case for exploiting these waste products. Broad-scale promotion of biofuels, however, has no future as a major strategy for reducing transport GHG emissions in Australia. Given that Australian agriculture is dependent on fossil fuels, encouraging crop production for biofuel manufacture fails the essential tests of life-cycle energy efficiency and net GHG emissions accounting, as research has demonstrated. In any event, the prospect that the nascent biofuel industry could be scaled up with sufficient speed in Australia to achieve a significant share of the conventional vehicle fuel market is fanciful. As experience from United States demonstrates, public subsidy of biofuel production is essentially another form of farm subsidy employing environmental protection as a rationale. Biofuels as an answer to climate change is in Black's words, a 'myth' (Black, 2001).

Australia already has an extensive uptake of LPG (Liquid natural gas) and CNG (Compressed natural gas) within the transport sector, largely by commercial vehicles. Promotion of these fuels for extensive application is a strategy without great appeal as a means to reduce GHG for several reasons. Principally, fuels derived from natural gas do not offer particularly large GHG saving over conventional fuels.

Two 'energy carrying' technologies have been widely espoused as having the potential to replace conventional fuels, each being at either end of the maturity spectrum, the 'immature' hydrogen technologies and the 'mature' option of electric-powered vehicles.

Despite the obvious appeal of hydrogen vehicle technologies from an environmental perspective, many years of an extensive research effort have failed to bring this option to fruition. To begin, hydrogen is only viable as a low-GHG emissions source of energy if it is derived from renewable energy sources, and at present, the world's hydrogen is principally derived from natural gas. Therefore, a 'green' system of hydrogen production is required, but which does not currently exist (in Australia or anywhere else at commercial scales. Regarding the vehicles, vehicle technology has yet to develop a suitable on-board storage to provide for vehicle ranges similar to conventionally fuelled vehicles (at a reasonable price). And even if and when hydrogen vehicles are produced commercially, there remains perhaps the greatest hurdle, that of developing a viable distribution system. Because of the inherent problems of distributing hydrogen (the energy density issue), it is unlikely that there would be a hydrogen distribution system that would equal the density of sales outlets of conventional fuels in large cities. It may be possible to have more centralised hydrogen fuelling stations suited for commercial vehicles and large fleet operators. It remains clear that hydrogen vehicles are far from becoming a mature vehicle technology and such a future is doubtful.[13]

Improving vehicle fuel efficiency offers GHG emissions reductions for distance travelled and has been a feature of energy policy and climate change policy for many years. In fact, there have been several significant improvements in vehicle fuel efficiency, but little improvements in overall fuel consumption. Vehicle fuel efficiency has been undermined by increases in vehicle weight and power, and the effect of additional powered equipment. As of today, Australian car fleet fuel efficiency is at the level of the Model-T Ford of the early

[11] Beer, T., Grant, T., Watson, H., and Olaru, D. (2004). *Life-Cycle Emissions Analysis of Fuels for Light Vehicles*. CSIRO: Melbourne.

[12] Op cit

[13] Service, R.F. (2004). The hydrogen backlash. *Science*, Vol. 305 (5686): 958—961.

20th Century, being some 11.4 litres/100 kilometres in 2006.[14] There is a considerable range of fuel efficiencies and GHG emissions in the Australian vehicle fleet; GHG emissions range from around 60 gCO_2-e/km to around 450 gCO_2-e/km. This suggests that from a strategic perspective, the easiest way to reduce GHG emissions through fuel efficiency approaches is to switch to those more efficient models.

Electric vehicles and Electric-ICE Hybrids are a mature propulsion technology already in the market, such as the well-known Toyota Prius (see, e.g., the Australian Government's Green Vehicle Guide).[15] There is of course the possibility of hybrid vehicles using electric power from the grid. Indeed, these hybrid vehicles seem poised to become the beneficiaries of the 'first wave' of a more widespread uptake of lower-emission vehicles, and probably more so than those using only electric motors. But here the emissions of the power source have to be taken into account (noting that coal provides the bulk of fuels used in Australian electricity generation). Compared to various forms of public transport, which suffer from the same problem, this option remains costly in GHG emissions per person-kilometre travelled. Added to this liability is the practical dimension of how quickly and extensively we can expect hybrid vehicles to achieve a dominant position in the Australian vehicle market.

Contrary to the degree of public interest and research investment in approaches to reduce emissions through changes to motor vehicle design and operation, these approaches have yet to make any significant impact on the GHG emissions from the transport sector. Faced with the need to significantly reduce emissions quickly, vehicle-based approaches simply cannot deliver this goal. It is proposed that market-based policies to direct technological development and consumer preferences for motor vehicle and/or fuel types have few prospects for achieving short-term GHG emission reductions where these technologies have not reached commercial viability at present. Further, there are a number of probable environmental costs associated with many of the potential alternative vehicle and fuel types that have let to be evaluated. Continued high levels of car driving are also associated with vehicle-based strategies and as such do not address other problems of such practices, such as the decline of children's independent mobility or the health implications of sedentary lifestyles.

Some time in the middle and longer terms these approaches can play a part in replacing the current vehicle fleet with one that produces very low GHG emissions; however, at this time it is not even clear what the appropriate technology choices will be, yet alone build a current GHG reduction strategy around this approach. In any event, this type of technology development will occur outside Australia and Australian national policy will have little impact on the direction, scale, or approaches fostered in this sector.

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A2. The Governance Failure of Transport Policy Path Dependence

As the world attempts to come to grips with the problem of climate change and develop appropriate long term solutions, it is as well to remember that institutional structures have accumulated around quite different problems and solutions. Institutions, it has been argued, are 'path dependent'.[16] Policy path dependence is essentially a governance

[14] Australian Bureau of Statistics (2007). *Survey of Motor Vehicle Use: 12 Months Ended 31 October 2006.* Publication No. 9208.0: Table 1.

[15] Available online at: www.greenvehicleguide.gov.au

[16] Arthur, W.B. (1988). Self-reinforcing mechanisms in economics. In P.W. Anderson, K.J. Arrow and D. Pines (eds.), *The Economy as an Evolving Complex System*. Addison-Wesley: Redwood, CA, page

failure. Just as industries can become locked in to the manufacture of a particular type of product, so governments can become locked in to the production of a particular type of policy. Governments seek rationality and try to reduce uncertainty. They do so by creating organizations, rationales, and routines for deciding on regulation and investment.

Large organizations, staffed by professional experts have grown up around the regulation of and investment in road infrastructure. Reasoning and language has developed around the need to build roads and save money on public transport. A powerful nexus of interests has formed around the construction of road infrastructure. The findings of recent research demonstrate the institutional strength of road planning and the correspondingly weak capacity for public transport planning.[17] The primary task of road planning agencies remains to relieve congestion on the roads for the benefit of private vehicles through the enhancement of and investment in the road system. Today in Australia the strength of the road planning agencies and their supporting actor networks is evidenced by the overwhelming balance of federal government transport infrastructure expenditure in favour of roads — a balance which will be difficult to change even with the current federal government's focus on the problem of climate change.

Justificatory routines have become established as conventional wisdoms. An example of such a routine is the normal mode of justification of road (bridge or tunnel) projects. Road projects are mainly proposed by State road planning authorities. They are subjected to benefit-cost analysis. The benefit is calculated as the aggregate of time saved by individual road users resulting from building a road. The costs are construction costs plus a variable range of social and environmental costs which are usually difficult to quantify. If the sum is substantially positive, building the road is considered justified.

The way this routine is conducted is biased in favour of road building for the following reasons:

1. Alternative modes of transport to satisfy the assumed travel demand are normally excluded. Data are readily available to enable projection of the traffic flows on the new road whereas data on public transport, walking and cycling are not collected, are less available or less reliable; or alternative modes may simply be excluded without explanation
2. Projects are considered one at a time, location by location. The impact of the intervention (whether building a road or some other solution) on the transport system as a whole is not considered. However, the 'induced traffic' effect of road building is now well understood. A system-wide approach to optimize the transport mix is lacking
3. The cumulative effect over time of 'spot' interventions in the transport system is not considered, and
4. The benefit-cost analysis is conducted by a consultant appointed and paid by the proponent of the project, creating a conflict of interest.

9—32; Arthur, W.B. (1988). Urban systems and historical path dependence. In J.H. Ausubel and R. Herman (eds.), *Cities and Their Vital Systems, Infrastructure, Past, Present and Future*. National Academy Press: Washington, DC; Denzau, A.T. and North, D.C. (1994). Shared mental models: ideologies and institutions. *Kyklos* Vol. 47 (1): 3—31; Low, N.P., Gleeson, B.J. and Rush, E. (2005). A multivalent conception of path dependence: The case of transport planning in metropolitan Melbourne, Australia. *Environmental Sciences*, Vol. 2 (4): 391—408; Low, N.P., Gleeson, B.J. and Rush, E. (2003). Making believe: institutional and discursive barriers to sustainable transport in two Australian cities. *International Planning Studies,* Vol. 8 (2): 93—114; Torfing, J. (2001). Path-dependent Danish welfare reforms: the contribution of the new institutionalisms to understanding evolutionary change. *Scandinavian Political Studies,* Vol. 24 (4): 277--309.

[17] Astle, R. and Low, N.P. (2008). *The Bias in Favour of Road Building: An Institutional Analysis of the Urban Passenger Transport Sector in Melbourne, Australia, 1956—2006 – Draft.* Australasian Centre for the Governance and Management of Urban Transport: Melbourne.

These four factors act together to inhibit economically rational solutions to the transport problem. The problem comes to be defined in terms of a 'normal' solution, rather than the solution emerging from a rational analysis of the problem. The recorded trend to car travel becomes self-fulfilling. The result is sub-optimal performance of the transport system.

If the problem is seen as maximizing consumer choice of travel mode, it is obvious that such choice is heavily dependent on transport infrastructure, the planning and financing of which is organized by government. Investment in infrastructure, in turn, affects the structure of consumer demand. Travel behaviour, assumed to reflect consumer demand, is then used to justify further infrastructure investment.

There is no denying that people like to own and use private cars for travel, and this desire to travel by car became the focus of a highly successful campaign by user and producer interest groups early in the twentieth century to press governments to provide the optimum infrastructure for driving.[18] Building roads replaced rail and tramways as the preferred infrastructure policy. Over a period of fifty years or so the continuous construction of roads in urban areas favoured the use of car transport over all other modes. Today, the observed inelasticity of demand for car travel can be ascribed just as reasonably to path dependence as to consumer preference. But this inelasticity is relied upon by private infrastructure investors to deliver economic returns from road building.

Although locking in certain choices of travel mode over time, transport path dependence is relatively benign when the price of car travel is low, or at least affordable. It creates transport rich and transport poor regions of cities, but households can to some degree trade off housing affordability against transport affordability. However, transport path dependence ceases to be benign when the price of car travel rises beyond what is affordable. Households find themselves locked in to locational decisions the consequences of which they did not expect and could not predict. The city becomes socially and economically segregated between an outer region dependent on private means of mobility and an inner region well equipped with public transport. Cheap low-density housing growth on the urban fringe is accompanied by a flight of money to the inner suburbs, blocking choice of relocation for households.

Setting aside the separate effect of the rising oil price resulting from the current supply-demand imbalance, the impact of an emissions trading regime must be to raise the price of carbon emissions – and that means the price of petrol, diesel and LPG — to the rate at which emissions decline. So transport cannot be protected from a fuel price rise that will break the current 'inelasticity' and change travel behaviour.

The obvious 'quick fix' is for people dependent on cars to trade down to smaller cars with lower fuel consumption and emission profiles. But this move will impose a substantial additional capital cost on households, and in any case can only be a temporary solution as the fuel price rise continues to bite. Mortgage-stressed households in particular will find such options less open to them. In the longer term, with emission reductions of the order of 80--90% on 1990, the full range of transport alternatives needs to be available for choice during the transition to low emission mobility. To reduce public anxiety that may lead to a political reaction against climate change mitigation measures, planning to maximize choice needs to begin immediately with the introduction of emissions trading.

Unless mitigating action is begun quickly, the transition period will entail some shocking social consequences. Mitigation can best be effected by balancing up mode choice opportunities across the whole metropolitan area of cities. That means optimizing the capacity of existing public transport networks, extending the network across the metropolitan region, and providing infrastructure for non-car, small vehicle, and foot modes.

[18] Davison, G. with Yelland, S. (2004). *Car Wars: How the Car Won Our Hearts and Conquered Our Cities*. Allen and Unwin: Sydney.

Mitigating the effects of the fuel price rise must also mean addressing the government failure of transport path dependence. Research suggests that external shocks coupled with political will bringing about change in institutional structures and routines for policy making can bring about a change of path.

A3. Failure of National Governance of Urban Transport

Within Australian federal governance, there is a demarcation of responsibilities between the three spheres of government for urban transport and part of the failings of the transport sector to respond effectively to the demands of environmental sustainability (and the climate change challenge) lies in these arrangements. One aspect of particular interest to GAMUT is that of national governance transport infrastructure, with the following material drawn from the recently-published research of Prof. Bill Russell.[19] As the importance of major infrastructure in the development of urban transport systems is well established, there is no need to re-iterate these points for the GCCR here.

Australia has entered a new phase in the federal and state decision-making processes over major transport infrastructure (such as roads, bridges, and railways). Historically, the provision of transport infrastructure in the Australian Federal system was allocated to State Governments. Within each state, capital works budgets could be developed that reflected established local needs. Often these needs were subject to scrutiny by a committee of parliament, such as the Parliamentary Public Works Committee. Major new works could be the subject of parliamentary debate and public consultation. Federal government played a minor role in these decisions, its role being restricted to quite specific areas: works within Commonwealth territories (e.g., the Northern Territory), defence-related works (particularly naval and air force bases), and provision of major airfields, after the advent of civil aviation.

Following the entry of the federal government into new fields of activity (coincident with the centralization of taxation powers in 1942), centralization of approval for State borrowings under the Loan Council, and entry of the Commonwealth into transport funding through centralist national governments, Commonwealth decisions now play a central role in determining what major road and rail investment projects occur in the States. In this circumstance, transport funding in the Australian federation has become difficult to interpret (in both the decision-making processes and the deliberations of decision makers). Essentially, the State and Territory governments propose annually road (and to a lesser extent rail freight) projects and these are then the subject of subsequent Commonwealth government funding announcements.

A significant development occurred with the introduction of Auslink in 2004. In 2004, the federal government released the Auslink White Paper, proposing significant increases in federal funding for transport projects, especially freeways and freight routes. The paper also proposed that Auslink could extend to the enhancement of railways used for national freight movements, but stopped short of including funding for urban public transport or port developments (other than transport links to ports). Subsequently, Bilateral Agreements were entered into between the Commonwealth Government and the State and Territory Governments for the payment of Section 96 Grants from the Commonwealth to the States subject to the Commonwealth's *Auslink (National Land Transport) Act* and the *Australian Land Transport Development Act 1988*.

The agreements set out the Commonwealth Government contribution for the five years of Auslink 1, from 2004—05 to 2008—09. For this period, the Commonwealth has allocated some $15.763 billion of national funding to state and territory governments for major road and railway projects, just over $12 billion being identified as Auslink funding. State bids for Auslink 2, to cover the next five-year period, were submitted to the Commonwealth during mid-2007. Several of the projects listed in this bid were announced as "promises" during the 2007 federal election campaign by both the Liberal Party and the ALP.

[19] Russell, E.W. (2008). *Who Decides Infrastructure Priorities? Federal Funding for Urban Transport in the Time of Climate Change.* Australasian Centre for the Governance and Management of Urban Transport: Melbourne.

In this process, a project may proceed with limited prior evaluation. The former state parliamentary public works committees no longer play a significant role. While the Commonwealth Land Transport Act nominally requires assessment, such assessment is not always transparent or comprehensive. For some projects, a formal Environmental Effects Statement is required, although this is not uniformly the case.

In January 2008, the new Rudd federal Government announced its support for a multi-billion dollar program of 'public-private partnership' construction projects to redress the so-called 'infrastructure gap'. At the same time, the government announced the establishment of a statutory advisory council — Infrastructure Australia — which will report directly to the new Minister for Infrastructure, Anthony Albanese, and will advise the government on the priorities for this construction program.[20] Sir Rod Eddington will head Infrastructure Australia and decisions are currently being made on the council membership.[21]

The Minister's Second Reading Speech on the Infrastructure Australia Bill on 21 February 2008 reflected the views of business groups such as the Business Council of Australia, Engineers Australia and Infrastructure Partnerships Australia, concerning a major "infrastructure gap" facing Australia. Infrastructure Partnerships Australia is a consortium of major construction firms and banks led by former Kennett Government Minister, Mark Birrell, and endorsed by State Premiers, John Brumby and Morris Iemma.[22] It has claimed that there is a $90 billion 'infrastructure gap' and published a state-by-state list of projects that it considers should be constructed.[23]

GAMUT is concerned that in this critical aspect of the transport sector there has been a decline in effective governance and that these recent developments in establishing Infrastructure Australia and Infrastructure Partnerships Australia will entrench and worsen this trend. Over the past decade or more there has been a progressive erosion of the assessment of major infrastructure projects before approval is given. In the past, the processes of public scrutiny included:

- Development of policy proposals/alternatives
- Benefit Cost Analysis
- Planning Act assessment of Net Community Benefit
- Environment Effects Act assessment
- Parliamentary Committee scrutiny
- Public consultation processes
- Treasury assessment, and
- ERC and Cabinet Approval.

However, today project lists are generated by private firms and consortia, there is close government/consortia collaboration, traditional merit assessment is nearly invisible, and most public environmental assessment is in retreat.

Specifically, in transport, this climate of dwindling public scrutiny has allowed state road construction agencies to produce extensive lists of urban and rural freeway proposals, which are given standing through their inclusion in the Auslink funding programs of the previous Commonwealth Government. Road funding under Auslink 1 (2004—2009) amounted to nearly $15 billion, and bids for Auslink 2 (planned by the previous government

[20] See: http://www.infrastructure.gov.au/department/infrastructureaustralia/structure.aspx

[21] Five members from the private sector will be nominated by the government, with one local government representative, with three Commonwealth and three state government-nominated representatives.

[22] See: http://www.infrastructure.org.au/index.html

[23] See, e.g., Infrastructure Partnerships Australia (n.d.). *Australia's Infrastructure Priorities: Securing Our Prosperity*. IPA: Sydney.

to commence in 2009) were for amounts many times greater than this: Queensland alone has bid for $30 billion under Auslink.

Another outcome of the current absence of public scrutiny and accountability has been the entry of party political interests into these decision-making processes. The existence of the extensive Auslink lists allowed both the ALP and the Coalition to 'cherry pick' from these lists during the 2007 election campaign and to promise the construction of a variety of road projects in marginal electorates. The evaluation underlying these announcements was not always clear.

As discussed in the following section, the current arrangement of federal funding for transport infrastructure is one that promotes road transport. Clearly, the construction of urban freeways in particular is recognised as one of the major factors behind the rapid growth in car-use in Australian cities since 1970.

A4. Imbalance between Road and Public Transport Infrastructure Investment and Institutional Support

Australia's post-WWII progression towards the car-dependency that now characterises its urban centres was less a phenomenon arising from the superiority of mobility using private motor cars than the consequence of the public financing of the major urban roads networks, consigning urban public transport to effective redundancy through efforts to largely confine public investments to recurrent expenditures, and urban planning outcomes that shaped urban growth in accordance with these investment priorities. State and federal expenditures have therefore favoured road transport over public transport, with resulting growth in road infrastructure and relative stagnation of public transport facilities. As a result, Australia's urban transport is dominated by private vehicle use.[24]

Although the story of the resource and expenditure imbalance is well known, the institutional aspects of this issue have received less attention. Yet, within the relevant institutional histories of the key state and federal agencies lies the historical explanations of how this imbalance has come about and how certain practices became routine features of urban transport governance. From this perspective, resource allocation is not the cause of the imbalance in urban transport, but one of several manifestations that are the result of the policies and politics of the agencies involved.

Many of the institutional imbalances that exist in the Australian states and territories between the road and public transport sectors are exemplified by the case of Melbourne, the subject of a recent GAMUT study.[25] This research provides an institutional analysis of the urban passenger transport sector, examining changes over the last fifty years in these institutional arrangements. When an organisation has sufficient strength and capacity it can drive its own preferred agenda forward. In contrast, when an agency is structurally weak, it has limited options for influencing policy debates.

The strength of the roads sector is based, at least in part, on its institutional arrangements within state government, which gives rise to its consolidated structural form, continuous engagement in the planning process, access to multiple funding sources, increased opportunities to influence the political level, regular chances to share and gather information at a range of forums, and the ability to leverage support from other players. Similarly, the compounded effects of the weakness of the public transport institutions create a substantial barrier. The weakness of the public transport sector is constituted from its fragmented organizational structure, the disjointed participation in planning

[24] See, e.g., Bureau of Infrastructure, Transport and Regional Economics (2008). *Australian Transport Statistics Yearbook 2007*. BTRE: Canberra; Mees, P., Sorupia, E. and Stone, J. (2007). *Travel to Work in Australian Capital Cities, 1976-2006: An Analysis of Census Data*. Australasian Centre for the Governance and Management of Urban Transport: Melbourne.

[25] Astle, R. and Low, N.P. (2008). *The Bias in Favour of Road Building: An Institutional Analysis of the Urban Passenger Transport Sector in Melbourne, Australia, 1956—2006 – Draft.* Australasian Centre for the Governance and Management of Urban Transport: Melbourne.

forums, greater distance and indirect access to the political accountability framework, fewer opportunities to network and transfer policy solutions and limited capacity to engage other players. It is the compounding effects of the trends in both sectors that have contributed to where we are today, with a deep-seated bias toward road construction as the priority solution for mobility needs.

The gradual consolidation of all roads-related functions within one stable organization enables the roads agency to share knowledge and experience and to coordinate policy responses and initiatives. In contrast in public transport, the fragmentation of functions between several organizations in the public and private sectors creates difficulties for flexibly responding to the policy environment. These structural changes in both sectors seem to be hindering the development of integrated transport planning. The consolidation of the roads sector enables it to pursue its own agenda, and the fragmentation of the public transport institutions means that there are external barriers to be overcome.

The long and stable history of engagement by the roads institutions in the planning process suggests that there is a strong and active capacity to influence the policy agenda. In contrast, the short and temporary participation of the public transport institutions on planning committees reveals limited opportunities to leverage support for policy ideas. Thus, the major developments in access to the planning process also appear to create barriers to sustainable transport. The ability of the roads institution to dominate the plans has enabled them to pursue a consistent vision for expanding the road network. And the limited capacity of the public transport institutions to find a voice in the planning process has tended to prevent any expansion of the public transport system comparable in scale to the expansion of the road infrastructure.

Access to public finance is connected with these institutional arrangements and is another factor contributing to the imbalance between road and public transport in Melbourne. Importantly, the shift from hypothecated funding from all levels of government to centralized budgeting concentrated at the state level reduced the direct power of the roads sector to control its revenue. However, it still retains a strong capacity to pursue its own policy agenda through leveraging other strategic resources, for example the re-introduction of a hypothecated state source and the ability to access federal funds for national roads. In contrast, the public transport sector continues to depend on state government funding, for which it has to compete with non-infrastructure policy areas for centralized funding. These shifting patterns in accessing funding also appear to be hindering the development of a better public transport system. Whilst funding for the urban road network is primarily determined by the State government, there are alternatives such as the aforementioned federal level and private financing (and models such as Public-Private Partnerships) both of which are utilized for larger road and freeway infrastructure projects. These options ensure that the roads sector is not totally dependent on one income stream and thus tied to the policy agenda of a single funding agency. The lack of alternative funding options in the public transport sector leaves it with highly circumscribed capacities to implement its preferred policy choices (especially where these involve capital expenditures).

Changing from limited accountability to a tighter level of oversight has potentially enabled the roads institution to influence the policy agenda at an earlier stage and certainly to maintain a closer connection with the political level. However, the stronger political oversight of the public transport institutions has given way to a closer bureaucratic accountability ensuring that there is less opportunity to provide input to the developmental policy stages. Thus, the changes in the accountability structure also seem to create barriers to a more balanced transport system with better public transport. The ability of the roads institution to access the minister, a key decision-maker, undoubtedly assists the organization in developing policies which are politically acceptable, discussing those which are less so, and influencing the broader agenda. The less direct access experienced by the public transport sector means that it is more difficult to propose tailored solutions.

The early and expanding access to a variety of forums provided the roads institutions with a number of opportunities for building relationships. In contrast the historically limited

chances for the public transport agencies to engage with other players have affected their ability to leverage support for policy ideas. The ability of the roads institution enables them to gather and build support for their policy preferences, for example sharing ideas with sister organizations in other States to lobby for additional funds from the federal level. In addition, the leadership of VicRoads in the multi–sector forum, the Victorian Road Based Transport Advisory Council, enables it permeate the public transport agenda.

Finally, the number and type of other players in the roads sector has been gradually increasing and the level of human and financial resources which these agencies command is significant. Whilst the composition of the public transport sector has also been expanding, it has done so more slowly and with each player having less powerful resources. The size of both sectors has increased, however the greater benefit appears to have been gained by the roads sector, thus these changes seem to have built more barriers to sustainable transport. The capacity of the roads agency to identify common and mutually beneficial interests enables it to effectively harness the support of others for its policy agenda. The limited synergy in the public transport sector makes it difficult to leverage support.

Thus, the roads sector performs better in the key institutional parameters considered here. The strength of the roads sector in each individual component provides it with solid building blocks and alternative strategies for pursing its own policy agenda. The more limited capacity to successfully overcome any obstacles and make the most of all opportunities on each parameter presents significant barriers to the public transport institutions. However, the biggest barrier is created by the combined effect of these capacities.

A5. Limits of Emissions Trading Policies for Reducing Transport Sector GHG Emissions

In considering GCCR TOR#4 that deals with the potential for market-based and other forms of intervention for mitigation and adaptation, GAMUT endorses the conventional position that transport sector emissions are not broadly amenable to being reduced through emissions trading and respond better to other policies and practices. On the issue of adaptation, GAMUT would argue that there is simply so little experience in adaptation policy that there is no substantive basis for an evidence-based assessment of policy approaches, but reference can only be made to speculation and reasoning.

Briefly, we re-cap the case against transport sector emissions trading. Much of the basic case was established by the Allen Consulting Group report *Greenhouse Emission Trading: Implications and Opportunities for the Australian Transport Sector.*[26] A permit system (for carbon emissions) is effectively unworkable for individual road users at present, although with the use of modern ICT such as 'smart cards', is potentially feasible. Alternatively, fuel producers could be required to use a permit system, however, it is questionable that any influence on decisions over fuel purchase would be shaped by what would be minor price signals when major price shifts are common in petroleum retailing without much effect on demand (i.e., petroleum demand is highly price inelastic in the short term). Accordingly, the Commonwealth Task Group on Emissions Trading established a principle of practical coverage of all sources and sinks and all GHG, "… with permit liability placed on direct emissions from large facilities and on upstream fuel suppliers for other energy emissions".[27] To quote the GCCR *Interim Report*: "An efficient ETS would have as broad coverage of emitting sectors as possible within practical limits imposed by factors such as measurability and transaction costs".[28] Such an approach is in line with most international practice in emissions trading, notably in Europe, where such schemes are applied to stationary energy and large industrial sources.

[26] Allen Consulting Group (2001). *Greenhouse Emission Trading: Implications and Opportunities for the Australian Transport Sector.* Report to the National Transport Secretariat.

[27] Task Group on Emissions Trading (2007). *Report of the Task Group on Emissions Trading*. Department of Prime Minister and Cabinet, Commonwealth of Australia: Canberra: page 100.

[28] Op cit, page 47.

In all likelihood, road transport will be totally or largely exempt from the forthcoming emissions trading scheme. It is almost equally certain that large-scale electricity generators will be part of an emissions trading scheme with the costs of emission permits being passed through to retail electricity consumers. Urban public transport is largely powered by electricity purchased with large contracts with the major generators. An issue for the GCCR to contemplate is that the imposition of emission trading will introduce a market signal that will reduce public transport demand relative to private vehicle transport demand, exactly the opposite of what is needed for GHG emissions reduction in the sector. GAMUT would hope that the GCCR will address this issue and consider ways in which any carbon emissions trading scheme could avoid creating this negative signal to public transport users.

A6. Social and Environmental Costs from Urban Transport as Externalities

As the GCCR Interim Report identifies broadly, and Issue Paper#5 makes clear for the transport sector specifically, there has been a consistent failure in decision making to consider social and environmental costs in major policy decisions.

Major decisions in transport and land use planning have been taken with little regard to environmental and social consequences in Australia's major cities, leaving the protection of these values to those agencies dedicated to their protection. Such an arrangement has seen both the transport system and urban growth occur with high social and environmental costs, as measured by the national GHG inventory and various state of the environment reports conducted by the states.

Decisions regarding major transport infrastructure projects routinely ignore the broader implications of their role in promoting increased GHG emissions, even though these are subject to environmental impact assessment procedures and have taken place since Australia's involvement in the UN climate change activities.

Part B. Role for Transport Sector Governance

B1. Recognition of Urban Mobility as a Public Good

GAMUT proposes that the climate change and transport issue be considered in light of the proposition that urban mobility constitutes a public good.

Across Australia's cities, the history of urban transport reflects the role of governments acting in recognition that urban transport systems failed when operated exclusively for private gain. In recent years under the influence of neo-liberal reforms, governments have frequently sought to revise the public role in the planning, financing, service provision, managing, and operating urban transport systems. Consequently, there has been as erosion of the understanding of urban mobility as a public good and this has given rise to a number of problems and misunderstandings both in governance and in the broader public discourse.

We begin with the proposition that reducing transport GHG emissions will be achieved primarily through public policy and not through corporate, NGO, or community initiatives, however important these may eventually become. In our society, it is the state (though the aegis of democratically-elected governments) that shapes the decisions over what constitutes a public good, of where the boundary between private and public interest is drawn, and of how public resources will be allocated to private interests. And while the community has moved readily to accept the proposition that the state will take the lead in addressing climate change (and that nations will correspondingly assume responsibility for addressing the international dimensions of climate change), there has not been a corresponding realisation of the implications for urban mobility and public policy.

Exemplifying the problems created by failing to appreciate the role of government in protecting public goods in urban mobility is the frequent debate over issues of subsidy and urban transport. Opposing sides usually comprise road advocates claiming that motorists are 'paying their way' (through fuel excises, GST, registration fees and insurance premiums, tolls, and other charges) and those who consider motorists and roads to be subsidised by taxpayers. GAMUT considers that the empirical evidence is mixed on this point, but roads and their users are clearly subsidised by public funds (e.g., Fuel subsidies,

road construction, road maintenance, and tax concessions to car users,). If social and environmental externalities are included in the equation then the public subsidy is greatly increased (e.g., Road trauma, air pollution effects on health, and noise pollution).

In many ways this example illustrates a broader truth, namely that a wide array of outcomes is determined by the policies and practices that express the values carried forth by the governance of the urban transport sector. In essence, the viability of the transport sector is determined by the decisions made by government. Private road transport is the outcome of governance and the allocation of public goods to private ends to no less a degree than for public transport. Car-dependency represents the outcome of a set of governance decisions and is not simply the result of the workings of consumer preferences in a free market. Rather, the urban transport system represents the historical accumulation of government's allocations of a public good, that of urban mobility, and the decisions of those seeking mobility from the choices arising from that allocation.

At the level of individual decision-making by travellers, oftentimes public discourse has framed these choices as being those expressing consumer sovereignty and the associated view that the transport system represents a collective market choice. Such views reinforce many of the environmental failings of Australia's urban transport system. Decisions over which journeys to make and what modes to employ are constrained by the design of cities and the transport options available, according to location. Mobility using the private car is a decision that imposes economic, social, and environmental costs on the transport system that the user is not required to fully bear. Urban mobility using private vehicles represents another market failure in the public good of urban mobility. That car-driving is equated with freedom is at odds with the need for vehicle manufacturers, repairers, insurers, road builders, traffic managers, energy supply and distribution industries, and so on. Car mobility is made possible only through great investment, social capital, urban space, resource consumption, and waste generation. Not only are environmental values degraded by urban car-dependency, but the assumption that private vehicles are to provide the bulk of urban mobility is deeply iniquitous to those of lower socio-economic status for the obvious reasons. In this way, the governance system that promotes car-dependency is also allocating the costs of benefits arising from the use of the urban mobility system in regressive manner. Good governance of the urban transport sector, therefore, must rest on recognition that urban mobility is a public good, but that the transport system itself has many characteristics of a common good, as has the environment itself.

B2. Making Sustainable Urban Transport a National Priority

GAMUT proposes that sustainable transport become a national priority and that the protection of environmental and social values be elevated in public policy formulation for transport and not ignored as externalities or left as residual problems to be addressed once other priorities have been satisfied.

Given the extent of the GHG emission reductions required from the transport sector from the types of targets discussed in the GCCR Interim Report, what is sought is nothing less than a revolution in urban mobility. Meeting the challenge of providing urban mobility at perhaps 10% of its current GHG emission levels at existing levels of mobility service necessitates transforming the transport system. To achieve such changes will take a revision to the tenets of contemporary transport and land use planning and practices, and seek to create a sustainable urban transport system. Only a transport system fully committed to the goals of ecological sustainability can achieve the types of environmental performance necessary for meeting urban mobility needs within a fully 'low-carbon' Australian economy and society.

At present, sustainable urban transport is not a national priority and as described above, there are a number of financial, economic, institutional, and governance barriers to reforming the urban transport sector. However, the basic features of a sustainable urban transport system have been identified and there has been considerable scholarly and

community interest in the prospects of an ecologically sustainable transport sector.[29] Here we provide a brief account of selected concepts, issues, goals, and practices needed of transport governance and associated institutions to transform the transport sector.

Although 'environmental sustainability' has been given an array of meanings and interpretations, a general working definition of environmentally sustainable transport is provided by the OECD:

> Transportation that does not endanger public health or ecosystems and meets mobility needs consistent with a) the use of renewable resources at below their rates of regeneration and (b) use of non-renewable resources at below the rates of development of renewable substitutes.[30]

Low considers that sustainability should be considered broadly and encompass the following dimensions:

- Social (e.g., access, community benefits, health impacts, security)
- Economic (e.g., employment, fiscal viability, public subsidy, efficiency), and
- Ecological (e.g., Material throughput, energy use, pollution, greenhouse gases).[31]

Transport is of particular importance for reducing the environmental impacts of industrial societies because of its direct environmental and social impacts and because of its wider role in industrial society in facilitating resource consumption and waste generation. Clearly, the new generation of transport policy is responding to the challenges of environmental sustainability and a measure of its success will be the extent to which the sector's environmental sustainability can be improved. Sustainability will vary according to different modes, but the overall goal for sustainability will be focused at the transport system. As a starting point, the most effective transport system is that which minimises the amount of travelling; merely to increase efficiency can produce undesirable effects, such as lowering the costs of travel and serving to increase demand (sometimes termed the 'rebound effect'). Transport poses a significant number of major environmental problems, whose resolution will be necessary for achieving a number of international environmental goals.

Given that the GCCR *Interim Report* and GCCR Paper#5 covering the transport sector have addressed the basic GHG emission profile of the transport sector and that we addressed the implications of these emissions for urban transport in the Introduction to this submission above, there is no need to re-iterate this material here, so we can simply identify some key issues.

To the need to cut GHG emissions in order to meet national targets and comply with international obligations can be added the future diminution of global oil reserves and associated rising prices in the face of growing global demand. If Australia continues its increasing reliance on oil imports to satisfy the demands of the transport sector, the economy will be increasingly exposed to rising international prices and increased expenditure. Current circumstances certainly suggest that the world's transport system is approaching a crisis as a result of its reliance on relatively cheap fossil fuel energy sources.

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[29] Examples of the growing literature on this topic include: Bannister, D. (2008). The sustainable mobility paradigm. *Transport Policy*, Vol. 15: 73—80; Banister, D. (1998). *Transport Policy and the Environment*. London: Spon; Low, N.P. and Gleeson, B.J. (eds.) (2003). *Making Urban Transport Sustainable*. Palgrave-Macmillan: Basingstoke UK; Newman, P.W.G. and Kenworthy, J. (1999). *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press: Washington, DC: and Whitelegg, J. (1997). *Critical Mass: Transport, Environment and Society in the Twenty First Century*. Pluto Press: London and Chicago.

[30] Organization for Economic Co-operation and Development (1996). *Pollution Prevention and Control: Environmental Criteria for Sustainable Transport.* OECD: Paris: page 54.

[31] Low, N.P. (2003). Is urban transport sustainable. In Low, N.P. and Gleeson, B.J. (eds.), *Making Urban Transport Sustainable*. Palgrave-Macmillan: Basingstoke: pp. 1—21.

Petroleum supplies nearly all the energy for Australia's (and the world's) transport and there are no obvious and economic substitutes. Further, Australia will be competing in this global market where demand is expected to be increasingly driven by emerging economies; the US Energy Information Administration forecast world oil consumption to reach 103 mbd by 2015 and 119 mbd by 2025 (i.e., a 50% increase over 2002).[32] Already the international spot price of crude oil has reached historic high levels and although this may be due to contemporary circumstances, rather than reflecting diminished global supply, we now have direct experience of the effect of rapidly increasing costs of transportation and an indication of what lies ahead for Australian urban transport under business-as-usual practices.

Following the logic of 'Hubbert's peak', namely that oil extraction follows a bell curve, it is argued that after the point of peak production, output falls, regardless of technological improvements or further drilling. Successful in predicting the path of declining US oil production (peak production occurred there in 1971), the model's application to global production has proved controversial. Globally, oil discoveries peaked several decades ago and today's oil consumption (around 30b barrels annually) exceeds the level of oil field discovery (less than ten billion barrels) by several fold;[33] few consider that any great oil fields remain undiscovered. A majority of the world's major oil producers have already passed their production peak and several exponents of peak oil theory claim that global peak production has already occurred or is relatively immanent.[34]

Again, the GCCR has recognised that active and public transport modes produce far less GHG emissions than fossil-fuelled transport modes and no further details are needed for to make the case for sustainable transport on these grounds. It is sufficient to make the following short observations on the general theme that public and active transport systems offer a number of solutions to the climate change challenges facing the transport sector:

- Public and active transport modes are more energy efficient than fossil fuel transport modes, so for given quantity of energy, a greater number of passengers can be moved between two locations, therefore can simply lower energy use and GHG emissions
- Rail, light rail, and trams can be operated on electricity (and usually are) that can be generated through known renewable technologies
- Cycling and walking consume no fossil fuels
- Public and active transport modes use known, available, and economic technologies, and the
- Costs of oil have been rising far faster than the fuels used to generate electricity.

There is much empirical evidence to support these claims. Cities that use public transport for a higher proportion of the transport task consume less energy and produce less GHG emissions than their private transport dominated counterparts (see Appendix I). Data presented by Scheurer et al show that public transport consumes very little energy in comparison to private transport.[35] Such are the energy and GHG emissions savings savings in switching from private transport to public transport that it is reasonable to state that there is no other practicable short-term solution for cities to reduce transport energy use and being able to meet current urban transport demands, given the current absence of low-

[32] Energy Information Administration (2005). *International Energy Outlook 2005.* EIA: Washington, DC.

[33] Heinberg, R. (2004). *Powerdown: Options and Actions for a Post-carbon World.* New Society Publishers: Gabriola Island, BC.

[34] Deffeyes, K. (2001). *Hubbert's Peak: The Impending World Oil Shortage.* Princeton University Press: Princeton, NJ; Campbell, C. and Laherrere, J. (1998). The end of cheap oil. *Scientific American,* Vol. 278 (3): 78—83.

[35] Scheurer, J., Kenworthy, J. and Newman, P. (2005). *Most Liveable and Best Connected? The Economic Benefits of Investing in Public Transport in Melbourne*. Metropolitan Transport Forum.

emission alternative fuels, the time needed for the development and diffusion of ultra-low emission cars, and the inability of walking and cycling to meet much of contemporary transport demands.

To these environmental dimensions of the case for sustainable transport can be added a number of claims for the protection of social values. For many unfortunate households, Australia's car-dependent urban mobility extracts a terrible toll. Australia has recorded in excess of 1000 road deaths annually since the 1930s; this toll reached a high of 3798 in 1970 and in 2005 there were 1627 deaths and 30,574 serious injuries.[36] To be fair, many fatalities occur in rural areas, but the majority involve urban locations (and urban dwellers). Given that public transport is far safer than road transport, the case that greater urban mobility using public transport will reduce road trauma has strong deductive appeal and is a major plank in the case for sustainable transport. There is also some evidential support; a study of a range of larger German and Swiss towns has suggested a link between mode split and safety; for example, Zurich's low car-use was associated with fewer road injuries than the higher car-using Hamburg.[37]

Road transport is also produces dangerous air-borne emissions (notably nitrous dioxide, benzene, and fine and coarse suspended particulates) with resultant effects on mortality and morbidity. Of concern are urban roads with high traffic loads where these pollutants become concentrated, affecting both outdoor air quality and adjacent indoor air quality. Health impacts are typically in proportion to exposure levels, where thresholds for effects are absent or very low. Many factors influence the health impacts of these pollutants, including the number of people exposed, their age and gender, and the exposure duration. Exposure to particulates small enough to enter the lungs increases mortality, morbidity, hospital emissions for respiratory and cardiovascular disease, suffering of respiratory symptoms, and use of medication by asthma suffers.[38] Petrol and diesel components are known carcinogens, with some studies showing an association between certain forms of cancer and exposure to urban air pollution. For people living close to busy roads, especially those routes with higher numbers of trucks and heavy vehicles, respiratory disease is higher with children being at a greater risk.[39]

Determining quantitative estimates of the known health effects of traffic emissions for populations is difficult and many different global estimates have been offered in popular literature. In fact, population health information at the regional or global level using standardised methods on morbidity, disability, and death due to traffic emissions are not available. One Australian review, by the Bureau of Transport and Regional Economics found that motor vehicle emissions might be responsible for air pollution that caused between 900—4500 cases of cardio-vascular disease, respiratory disease, and bronchitis, and between 900—2000 early deaths, with an economic cost of AUD$400 million—1.2b for the former and AUD$1.1b—2.6b for the latter.[40] Experts have noted that while technological improvements and stricter emissions standards on have reduced these pollutants, these

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[36] Australian Transport Safety Bureau (2007). *Road Crash Casualties and Rates, Australia, 1925 to 2005.* Canberra.
Available online at: http://www.atsb.gov.au/publications/2008/1925_05_casulaties.aspx

[37] From the GTZ project, Transport Demand Management: Select Experiences from Germany and Switzerland, Cities on the Move: *World Bank Urban Transport Strategy Review*, Budapest, 2001.

[38] Dora, C. and Phillips, M. (eds.) (2000). *Transport, Environment and Health*. WHO Regional Publications, European Series, No. 89. WHO Regional Office for Europe: Copenhagen.

[39] See, e.g., Ciccone, G., Forastiere, F., Agabiti, A., Bisanti, L., Chellini, E., Corbo, G., Dell'Orco, V., Dalmasso, P., Volante, T.F., Galassi, C., Piffer, S., Renzoni, E., Rusconi, F., Sestini, P. and Viegi, G. (1998). Road traffic and adverse respiratory effects in children. *Occupational Health and Medicine*, Vol. 55 (11): 771—778.

[40] Bureau of Transport and Regional Economics (2005). *Health Impacts of Transport Emissions in Australia: Economic Costs*. Working Paper 63. BTRE: Canberra.

gains have been offset by increasing vehicle miles travelled, the increase in diesel vehicles in many places, congestion, and the number of short trips (catalytic converters are quite inefficient in the first minutes of engine operation).

Other health effects include those caused by noise, the effects on mental health, and arguably, the indirect arguments that associate motorised transport and the health effects of increasingly sedentary lifestyles, such as heart disease and obesity associated with increased motorised transport. Recently, there has been a specific interest in the decline of children's independent mobility in Australia's car-dependent cities.

Realising a sustainable transport system is clearly a difficult and complex task (and beyond the scope of this submission to address in any depth). One contribution to the debate is that of Kennedy et al who identified four essential components of the process of creating urban sustainable transport, namely:

1. Establishing effective bodies for integrated land use and transportation planning
2. Creating fair, efficient, and stable funding mechanisms
3. Investing strategically in major infrastructure that supports sustainable transportation, and
4. Supporting investments through local design.[41]

Although this list is entirely unremarkable in its composition, as the diagnosis offered in Part A of the submission describes, Australian cities are generally quite some way from having these 'pillars' of sustainability in place. Indeed, as described above, Australia has in many instances the antithesis of these supports for a sustainable transport system. Consistent with Kennedy et al, GAMUT offers that the basis of creating a sustainable transport system is not technology choice or appropriate markets, per se, but governance, as discussed below.

B3. Appropriate Governance for Urban Transport Planning and Regulation

GAMUT proposes that appropriate governance structures, institutions, and practices are required in the federation of Australian governments in order to facilitate sustainable urban transport (and thereby having the potential capacity to greatly reduce GHG emissions form the sector and to respond to other climate change challenges).

Urban transport is a complex sector and demands on governments are already diverse, multi-faceted, and dynamic. Governance in an era in which climate change imposes new demands and expectation will be particularly difficult. Amongst the key governance and institutional themes will be:

- Planning & regulation
- Economic productivity
- Management of operations
- 'Territory' (the span of governmental interests and responsibilities)
- Technology choices
- Ecological sustainability, and
- Community interests.

There are no ideals for governance for managing urban transport or any other complex sector in pursuit of the goal of ecological sustainability. There are however, a number of reviews of well-performing governance regimes and examples of best practice for a range of transport systems. It is possible to draw a number of generic lessons from this collective experience to inform our ideas of how to better manage the Australian urban transport systems in order to respond to the demands of climate change plans and policies.

At the federal level, there are a number of governance reforms that are urgently needed, particularly in regard to transport infrastructure priorities and decision-making processes.[42]

[41] Kennedy, C., Miller, E., Shalaby, A., Maclean, H. and Coleman, J. (2005). The four pillars of sustainable urban transport. *Transport Reviews*, Vol. 25 (4): 393—414.

Australia is exceptional in the industrialised world (and amongst many developing nations) in not allocating federal resources to urban public transport infrastructure projects. As a consequence, the bias in urban transport systems towards road transport is being made worse. Therefore, the Commonwealth Government should reverse existing policy by providing funds for urban public transport projects. Without federal funding assistance, state governments will continue to be highly constrained in their ability to invest in public transport in the growing major urban centres where these needs are greatest.

Other measures are needed to accompany this needed major policy reform. It is essential that the Infrastructure Australia project appraisal and assessment includes determining the impacts of major transport infrastructure projects in relation to such factors as:

- Likely impact (positive or negative) on Australian greenhouse gas emissions
- Maintaining economic and social resilience in the face of rapidly increasing oil prices, and
- Containing the physical 'footprint' of transport infrastructure in the urban environment.

Infrastructure Australia's board should be balanced across the different transport interests and include members with expertise in transport responses to climate change. The proposed infrastructure audit to be undertaken by the new Infrastructure Australia during 2008 should look at transport strategies and necessary policy steps. Auslink is currently serving to directly promote increasing GHG emissions from the transport sector. The existing process of building up the Auslink program from state road authority bids should be replaced by a more strategic national programming process following the completion of the infrastructure audit. The extensive freeway 'wish lists' advanced by state governments through the Auslink 2 process should be rigorously scrutinised in the light of the negative impact of many such projects on climate change and urban amenity. It follows that as the imperatives for action on climate change intensify, it is vital that there be stringent and transparent processes for the evaluation and public scrutiny of infrastructure projects that may be given Commonwealth support.

For state, territorial, and city governance there is a far greater range of factors to take into account, given that it these spheres of government responsible for the majority of planning, regulation, and management of urban transport. GAMUT considers that one institutional model of particular worth practice for operating, planning, and managing f integrated public transport systems is the *Verkehrsverbund,* which has been widely adopted in European cities.[43] Based on the attributes associated with better-performing governance of urban transport from a range of studies, it is offered that governance of urban transport for achieving ecological sustainability needs to exhibit many of the following characteristics:[44]

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[42] See Russell, E.W. (2008). *Who Decides Infrastructure Priorities? Federal Funding for Urban Transport in the Time of Climate Change.* Australasian Centre for the Governance and Management of Urban Transport: Melbourne.

[43] See, e.g., Pucher, J. and Kurth, S. (1996). Verkehrsverbund: The success of regional public transport in Germany, Austria and Switzerland. *Transport Policy*, Vol. 2 (4): 279—291.

[44] See, e.g., Glover, L. (2007). *Integrated Management of Sustainable Urban Passenger Transport Systems in Dispersed Cities: A Review of Successful Institutional Interventions.* Volvo Research and Education Foundation Smaller Project SP-2004-10. Australian Centre for the Governance and Management of Urban Transport, University of Melbourne, Melbourne, Australia; Reitveld, P. and Stough, R. (2004). Institutions, regulations and sustainable transport: A cross-national perspective. *Transport Reviews*, Vol. 24 (6): 707—719; Van Egmond, P., Nijkamp, P. and Vindigni, G. (2003). A comparative analysis of the performance of urban transport systems in Europe. *International Social Science Journal,* Vol. 55 (176): 236—247; Pucher, J. and Kurth, S. (1996). Verkehrsverbund: The success of regional public transport in Germany, Austria and Switzerland. *Transport Policy*, Vol. 2 (4): 279—291; Zografos, K.G., May, A.D., Marsden, G., Kallioinen, J. and Tegner, H. (2004). *Surveys of Transport Institutional Systems in Europe*. Transport Institutions in the Policy Process (TIPP): Deliverable 3. TIPP Consortium, European Commission.

- Vesting the essential powers of planning and management within a single agency confers a range of organizational benefits that are lost when a multiplicity of agencies are required to coordinate their activities
- Associated with the strengths of a prime agency operating within the sector are the advantages of having a single 'territory' under the control of that agency, as mismatched boundaries and agency powers are a cause of disputation and inefficiency
- Successful agencies and instruments of governance benefit from having adequate and relatively reliable sources of funding, and decision-making processes that produce outcomes consistent with the longer-term plans and goals of governance
- Institutional designs are matched to local circumstances
- Political endorsement and support is usually associated with successful governance, and the agencies and institutions involved display high levels of competence, and often have high-quality leaders and managers
- Key institutions exhibit relative stability and longevity
- Information collection and analysis is sufficient to enable performance of the systems under the controls or influence of governance systems to be monitored and assessed, both of the institutions involved and of the transport system, and
- Cooperation, liaison, and coordination with related spheres of governance are effective.

In the following section, the application of governance is described.

B4. Focus Required on Integrated Urban Transport Systems

GAMUT proposes that major urban transport systems be planned, developed, managed, and operated as a means to achieving sustainable transport and for addressing climate change priorities, rather than continuing to rely on approaches that are sectoral, divided, and incomplete.

As a challenge to governance, creating the institutional settings to undertake integrated transport concerns the realms of influence over which institutions operate (or rather, the extent to which they can exercise their influence). Simple levels of integration between modes may be achieved cooperatively with a single agency and can be resolved as a matter of *policy* or management directives. However, achieving more ambitious levels of integration involves engaging a wider field of actors and interests. At the small scale, transport integration concerns a few transport interests, but to involve the whole urban transport system (private and collective modes) or urban planning at the broad scale, transport integration involves agencies in a wider institutional setting and is far more difficult, complicated, and contentious to accomplish.

Integration can function at a number of different levels within transport systems. At the institutional levels, integration can involve institutional cooperation between transport actors, integrated strategies between environment and transport actors, integrated transport and environmental monitoring services, integrated strategy and policy development and implementation, and formal and open systems of public accountability for system operation. Critical to integration is, of course, the internal integration of planning and operating a transport system as a whole system (such as transport planning that embraces both road and public transport) and integration between transport governance and urban planning governance. Here, the concept of 'transit-oriented development' is a critical aspect of bringing urban planning and design into the realm of transport planning. Although many scholars and researchers have long advocated the coordination and

integration of transport and urban planning, these functions are usually separate. In this regard, Perth represents an innovative and progressive Australian example.[45]

Public transport services in Australian cities do not display a high level of integration, each mode usually operating with considerable independence. Reform through adopting an more integrated approach would see coordination across different modes, unitary fare and ticketing systems, Coordinated timetables across systems, provision of city-wide services, inner-city—suburban linkages, and cross-city linkages. Transport planning can consider system-wide needs and address system-wide modal shift and strategies to promote passenger demand. Such integration will then inform a range of other decisions, such as over technology choices, which can take into account their environmental performance, economic performance, safety and comfort, and compatibility within the wider system. It follows that the provision of infrastructure and services will also be influenced by integration, with issues such as infrastructure capacity and investment levels and needs been re-framed. Environmental performance can take into account Energy use and efficiency, GHG emissions, emissions to air and water, noise levels, accidents and safety measures, and monitoring and performance evaluation.

Many studies and reports from Europe and North America have explored and described modal integration. Here, we reproduce the findings of the European Hi-trans report[46]:

- An integrated network of all public transport modes and different types of operations, with easy and comfortable transfer opportunities at several places in the city region, not only at the main station or in the city centre
- Exploiting the different quality and capacity aspects of the various modes and services of public transport by putting the right mode and type of service in the right place in relation to customer demand and efficiency of operations
- A simple network with a clear line structure that is easy to learn and remember for all citizens partly due to a well thought-out long-term planning strategy for the urban structure of land use, public transport and road network of the region
- Direct route alignment and the fastest possible speed of vehicle operations with reliable timetables
- High-frequency services where and when the demand is reasonably high
- Coordinated pulse timetables where demand is weaker
- Efficient pendulum lines running through city and suburban centres and major public transport interchanges, that connect major housing and working areas of the region to the city centre, suburban centres and public transport modes, and
- Supporting soft measures such as fare structure, ticketing systems, information and marketing, preferably combined with restrictive policy measures towards car use that can significantly influence public transport demand and the success of all the other measures.

B5. Improved Planning, Managing, and Operating of Urban Public Transport

GAMUT proposes that improved planning, managing, and operating of urban public transport is essential for increasing public transport use.

GAMUT considers that the highest immediate priority for the urban transport sector be given to shifting the transport task in cities from a dependency on private cars to a far greater use of public and active transport modes. As described above, such as strategy can produce short-term results and produces net environmental and social benefits.

Worldwide and Australian experience has shown that patronage on public transport responds positively to improved services, the so-called 'virtuous circle' and conversely, the 'vicious cycle' of declining services, declining patronage, and declining revenues, is all too-

[45] Curtis, C. and James, B. (2004). An institutional model for land use transport integration. *Urban Policy and Research*, Vol. 22 (3): 277—297.

[46] Nielson, G. (2005). *Public Transport – Planning the Networks*. Hi-Trans Best Practice Guide. Hi-Trans: European Union: page 8.

well known and experienced in Australian cities. In this section, we offer a number of examples of the types of changes that can be made to transport systems and offer some 'best practice' examples and small case examples. Clearly, this is listing is designed to indicative, rather than comprehensive, but these cases demonstrate that that when the corrective governance structures are place, suitable institutions designed, and appropriate levels of resources provided, then public transport can be improved so as to greatly increase patronage.

Features of high-performing public transport systems include high-frequency services with adequate 'effective' speeds for urban journeys, reliable services, and a sufficient density of services across the city to satisfy the majority of urban mobility needs. Intermodal connections are important as this provides service coverage across the city and involves coordinated services (and coordinated timetables, both modal and inter-modal), inter-modal connectivity and easy transfers, integrated ticketing systems, accessible and legible information and advisory services (for journey planning and ticketing). High comfort levels are also a feature of these 'best practice' cases, where service providers offer clean vehicles and passengers have high perceptions of personal security within vehicles and around the precincts of stations and boarding/ disembarking points in the city. Social equity considerations are usually addressed by offering services and facilities for the disadvantaged and children.

In Perth, for example, per capita use of public transport has been rising steadily and significantly for almost a decade. This appears to be related to service provision in two ways. Firstly, new rail infrastructure has greatly extended service delivery (notably, the new Perth—Mandurah line, some 70 km in length) and this has been linked with a re-organisation of the bus 'feeder' services, thereby extending the catchment for the rail services. Secondly, there has been an operational focus on passenger service through the ticketing system revisions, new timetables, and a uniform bus livery 9although there are multiple private operators).

Vancouver, Canada is notable for maintaining per capita public transport use through a prolonged period of high population growth, with notable growth in use since 2001. There has been considerable attention given to this city and region because of the effectiveness of land use and transport policies. Land use polices have been reasonably successful in containing employment and residential housing distribution. Service provision by public transport is deemed to be of a fairly high standard, but importantly, Vancouver has adopted a range of demand management strategies to reduce road use. Simply enough, an essential component of this approach has been to greatly restrict increasing road capacities; Vancouver is actively using road congestion to dampen down demand.

Zurich, Switzerland is also of particular interest. Essentially, Zurich has pursued long-term polices over many years to improve public transport and to reduce urban car traffic, which has involved making car use less attractive as a mobility choice. When two underground transport system proposals were rejected by the citizenry in the 1960s and 70s, the local authorities took this as a mandate to greatly improve the existing tram and bus systems. Today, Zurich operates one of the most efficient and highly-used public transport systems in the world, featuring high-quality services (a comprehensive network, high frequency services, and an effective timetable system), with an integrated system of the suburban railways, trams, and buses, an integrated ticketing system, and an integrated timetable.

A number of other cities around the world provide 'best practice' examples of attracting high levels of patronage to public transport through the provision of high-quality services. These urban centres can inform and guide Australian urban transport governance planning, developing, and operating public transport systems that will attract considerably higher patronage than at present.

B6. Recognising Social Justice in Responding to Climate Change

GAMUT proposes that future decision-making in the transport sector in response to climate change issues should recognise the importance of social justice.

One consequence of the types of climate change policy measures undertaken in Australia at all levels of government, the so-called 'voluntary measures' approach, is that there have likely to have been few serious social and economic consequences of these initiatives to date. These circumstances will not prevail as climate change will create a range of social and economic impacts and these will have implications for social equity. As the GCCR *Interim Report* makes clear, there are three primary avenues through which climate change can generate social impacts: through climate change impacts, response measures to climate change to mitigate GHG emissions, and through the effects of adaptation policies and responses. One virtue of the GCCR is that it can bring this neglected dimension of the climate change debate forward.

However, as a consequence of the manner in the Australian climate change debate has evolved, we currently have a very poor knowledge and conceptual base for considering the social equity issues inherent in climate change. To date, the social implications of climate change for Australian cities is poorly researched and understood.[47] Climate change will be an additional effect that will either amplify or reduce existing patterns of inequity. At least some dimensions of the social implications of transport in Australian cities have been studied and Social Research in Transport internet-based clearinghouse project is a resource of such studies.[48, 49] We have, therefore, some understanding of the distribution of social disadvantage produced by existing urban transport systems in Australia.

The current mode balance across Australia's cities, with its heavy dependence on cars, limits choices with regard to mode share. For many, including those financially disadvantaged in outer suburban and rural areas, the choice to reduce motorised transport equates to a choice of restricted movement and social isolation. This forced choice affects about one-third of the population who cannot drive due to age, mobility restrictions or not owning a car.[50]

An absence of the options to use public and active transport in car-dependent cities reinforces the use of private cars to provide the bulk of the urban mobility task. Car-dependency results in conditions where this mode of transport absorbs public and private capital, urban space, and other resources. Sunk investments into private transport are often used as a rationale by households and governments to continue to use and invest in private cars and the associated infrastructure. Yet this very dependency creates the conditions whereby the inequity in mobility becomes institutionalised because the transport system is oriented towards the needs of car-users, effectively 'leaving behind' those without access to car transport.

Sustainable transport carries forward an agenda of social justice. For transport services, goals of equity and fairness can only be satisfied through the means of access to those services, such as influenced by the proximity of the service, the barriers faced by the disabled, service costs, and other factors. Access to transport services and the quality of that service exerts an influence on both quality of life and social opportunities. Private transport is expensive and those of low and modest income simply cannot afford transport by this means, so that public transport provides the means of transport to such groups.[51]

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[47] Glover, L. (2007). Social impacts and implications of climate change for transport, land use, and planning in Australian cities. *Just Policy*, No. 46: 45—51.

[48] E.g., Currie, G. and Senbergs, Z. (2007). *Exploring forced car ownership in metropolitan Melbourne.* Australasian Research Forum 2007.

[49] Available online at: http://www.sortclearinghouse.info/

[50] The Coalition for People's Transport (2007). *Transport and Liveability: The Path to a Sustainable Victoria*. Available at: http://www.vcoss.org.au/documents/vcoss%20docs/transportDOC:0601-transport_livability_statement.pdf

[51] Ausroads' *RoadFacts 2005: An Overview of the Australian and New Zealand Road Systems* (Ausroads, 2005: Table 1.3) reports that annual private motoring expenditure in 2004 was AUD$10,426

Failures and inadequacies in public transport confer a social cost on those at the lower ends of the social-economic continuum. Such costs are distributed unequally in society, with the elderly, disabled, lower-educated, fixed-incomes, welfare recipients, immigrants being most likely to have greater need of public transport, being of lower socio-economic status. An emerging issue is the prospect that demographic changes in Australia, specifically the aging of the 'baby boomer generation' (i.e., those born between 1946—1964), will increase the demand for public transport and transport for those with 'special' needs (in contemporary Australia, those unable to use a private car for mobility are often considered to be exceptional; car-driving is the norm).

Two studies from Griffith University's Urban Research Program connect the issues of social welfare and vulnerability to oil prices around the theme of the spatial distribution of social and economic disadvantages within Australian cities. With the advent of rising oil prices, Dodson and Sipe use the concept of 'oil vulnerability' to describe the how outer-suburban areas will be most disadvantaged by higher fuel costs because these areas have concentrations of lower-income groups and are largely without access to public transport.[52] A refinement of this work examined the influence of rising mortgages, rising fuel costs, and inflationary pressures in Brisbane, Gold Coast, Melbourne, Perth, and Sydney, finding that vulnerability is lower in close proximity to the CBD and higher in outer suburbs.[53]

Finally, the current mode balance increases the social isolation of car drivers and attendant levels of fear of the other, inability to use public transport and lack of engagement in community activity. Hence, "… the socialization of children-especially well-to-do children-into fear of the other contributes to their increasing need to be separate, which in turn, leads the next generation of adults to engage in higher levels of destruction to the physical and social fabric of society to maintain their separateness"[54] Residents of the inner city and those living close to roads have a higher exposure to air-borne and pollutants generated by road users.

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for a 'medium-sized car' (comprising depreciation, fuel, registration, insurance, motoring association membership, interest, service and repairs, and tyres).

[52] Dodson, J. and Sipe, N. (2005). *Oil Vulnerability in the Australian City*. Research Paper 6. Urban Research Program, Griffith University: Brisbane.

[53] Dodson, J. and Sipe, N. (2006). *Shocking the Suburbs: Urban Location, Housing Debt and Oil Vulnerability in the Australian City*. Research Paper 8. Brisbane: Urban Research Program, Griffith University.

[54] Sutton, S.E. (1997). Creating landscapes of safety. In Ellin, N. (ed.) *Architecture of Fear*. Princeton Architectural Press: Princeton, NJ: 241—252.

Appendix I

Table 1. Energy Use in Passenger Transport, per capita, Selected Cities.

City	Private Transport (GJ)	Public Transport (GJ)	Total (GJ)
Helsinki	2.4	10.5	12.9
Copenhagen	1.3	14.5	15.8
Vienna	1.4	15.7	17.1
Zurich	1.3	17.0	18.3
Stockholm	1.7	19.1	20.9
Oslo	1.1	19.9	21.0
Geneva	0.7	22.9	23.6
Montreal	1.2	27.9	29.1
Sydney	1.1	28.7	29.8
Brisbane	0.9	30.7	31.6
Vancouver	0.8	31.0	31.8
Melbourne	0.7	31.6	32.3
Perth	0.8	33.2	34.0
Toronto	1.0	34.6	35.7

Source: Scheurer, J., Kenworthy, J. and Newman, P. (2005). *Most Liveable and Best Connected? The Economic Benefits of Investing in Public Transport in Melbourne*. Metropolitan Transport Forum,: page 9, Figure 14.