Do people really love their cars or do government's just love road building … and what are the implications for sustainability?

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ABSTRACT

When confronted by problems like traffic congestion, amenity impacts and the need to curb GHG emissions, many transport commentators will claim that 'people love their cars'. The rejoinder is that little can be done to reduce high levels of car-use in Australian cities and that community attitudes are responsible.

This paper confronts this view by first examining actual travel patterns in Australian cities where it is shown that the transport choices people make are highly dependent on the transport options made available to them. Significantly, individuals in the community are not responsible for the provision and state of these networks but governments and transport professionals are. To better understand how the relationship between travel behaviour and infrastructure provision plays out, this paper briefly examines the travel behaviour changes that occur after a new urban motorway is opened to traffic. Through use of a Sydney case study, it is shown that adding new road space generates a sudden increase in road trips referred to as *induced traffic growth*. That dramatic changes to road travel behaviour are triggered by road building decisions from governments provides a different way of approaching the issue of transport and sustainability.

The paper concludes that achieving greater sustainability within the Australian transport sector does not require changes to public attitudes, but rather, requires changes to transport decision-making processes and transport service supply.

1. INTRODUCTION

Read any newspaper article by the popular press on urban roads and the problems of traffic congestion and in most cases the journalist will insert the observation that 'people love their cars'[1] (see for example, Glavin 2009). But its not just journalists who do this, statements by Transport Ministers often make the claim that people love their cars too (see for example, SMH 2007).

The claim is significant because for several decades it has provided the intellectual justification for the construction of extensive urban road networks. Such networks in turn facilitate travel behaviour that creates higher levels of greenhouse gas (GHG) emissions and consumption of finite fossil fuels (Kenworthy 2003), air pollution dangerous to human health, problems with congestion (Mogridge 1997) and poor urban amenity (Appleyard, Gerson and Lintell 1981), suburban sprawl and higher transport operating costs at the macro city scale (Zeibots 2002). The high levels of investment required to build such road networks has also meant relatively lower levels of investment in public transport. Public transport produces less

[1] While an extensive bibliomentric analysis has not been undertaken to substantiate this point, I would invite readers to keep this point in mind when reading popular commentaries on transport policy and see how often this occurs.

GHG emissions per passenger kilometer and can be powered by electricity generated from renewable sources (Kenworthy 2003).

As the world becomes more aware of the problems of climate change and peak oil, and the need to provide transport infrastructures able to sustain the access need of populations while we confront these pressures, the legacy of the claim that 'people love their cars' can be seen to have been unhelpful. Overcoming this claim is an important task for those interested in the implementation and operation of sustainable transport systems.

This paper confronts this contention by examining the results of attitudinal surveys on transport in tandem with empirical data that demonstrates critical features about the nature of the relationship between changes to transport supply and travel behaviour.

In Section 2, a brief review of attitudinal surveys is provided which shows that the primary reason cited for people's mode choice — private motor vehicle or public transport — is relative speed, or whichever mode is quickest. The views of the general community on transport policy is also reviewed and compared with those of policy makers.

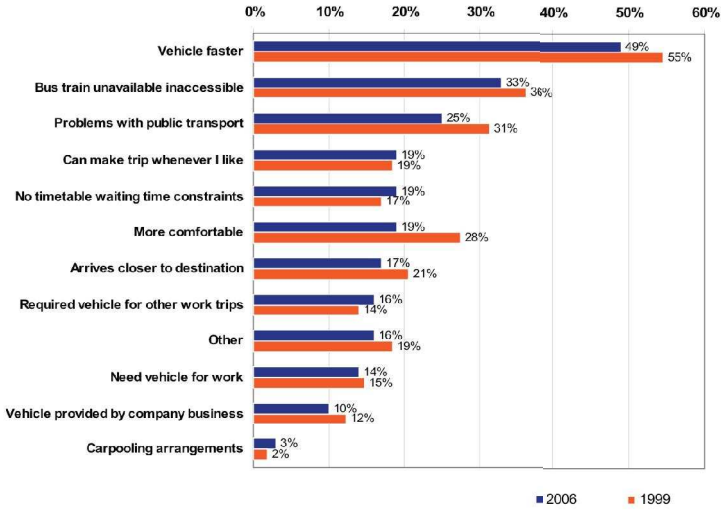
In Section 3, travel behaviour before and after the opening of an urban motorway in Sydney is examined. The empirical data show a range of responses triggered by changes in relative travel speeds including an increase in the total number of trips or induced traffic growth. Significantly, this is triggered by the decision to add road space to the network — a decision made by politicians and transport decision-makers not individual motorists.

In Section 4, the wideser sustainability implications for transport policy are discussed with the paper concluding that what people actually do and want is fundamentally different to many popular commentaries and perceptions of politicians and transport decision-makers.

2. ATTITUDINAL SURVEYS ON TRANSPORT USE IN AUSTRALIA

In Australia, government transport agencies regularly undertake household travel surveys as a way of monitoring trends in travel behaviour for populations living in Australian cities. In addition to recording data on trip rates, distances and purposes, individuals are also asked questions about their reasons for choosing one transport mode over another for trips like their journey-to-work. Figure 1 shows the results of just such surveys for people living in Sydney in 1999 and again in 2006.

Figure 1 Reasons for using a car to travel to work (1999 and 2006)



Source: TDC. 2008, *2006 household travel survey: summary report.* Transport Data Centre, NSW Ministry of Transport, Sydney, p. 13.

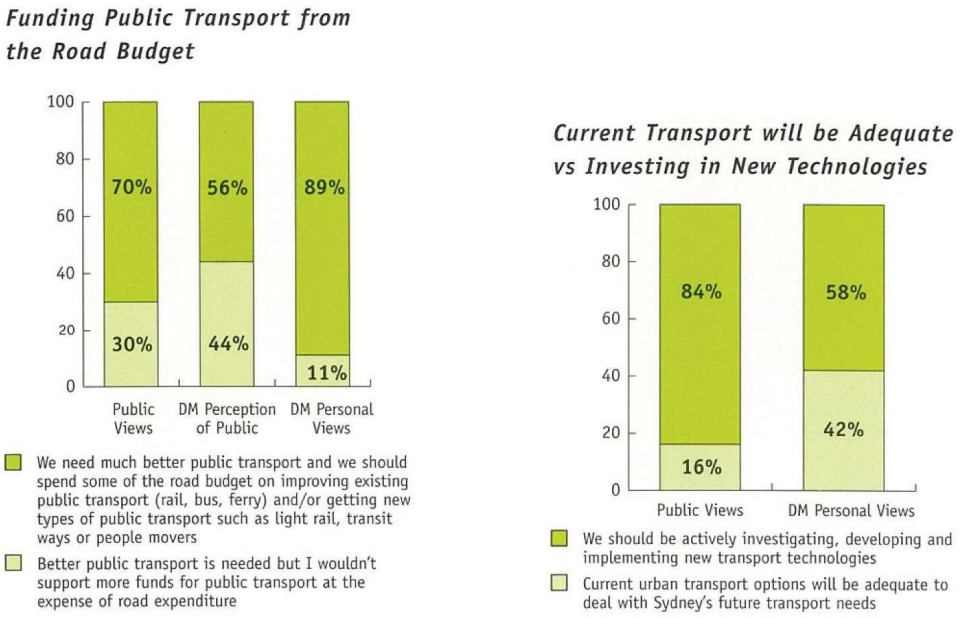
As can be seen in Figure 1, in both survey years around 50 per cent of respondents cited quicker travel speeds as a reason for why they chose to use their car over alternate public transport options for their journey-to-work (TDC 2008, p.13). The second highest scoring reason at around 35 per cent was the simple unavailablility of public transport options. These findings are consistent with similar surveys where the highest scoring reason for choosing one mode over another is its relative speed followed by the point that where public transport options are not available people use their cars because they have no other option (for example, UTS 2009).

This is a significant finding because it suggests that if the relative speed of public transport services can be increased so that the travel time component of the cost of trips is reduced, then more people would use public transport — which has superior sustainability credentials. And similarly, that if public transport were actually provided so that it coud be used, then some people would who currebtly are not.

Recent attitudinal surveys of the general community on questions relating to transport policy show the majority feel some of the funds currently invested in urban road development should be invested in augmenting public transport networks (Carolan 2009). This result is not new. Similar surveys carried out in the past have shown the same results (for example, Glazebrook 1997, p. 2).

Significantly, surveys of political and professional transport decision-makers show that a high proportion of these people believe the general community wants more roads and urban motorways to be built rather than public transport (Glazebrook 1997, p. 2). As can be seen in Figure 2, in relation to policy issues like whether funding for public transport development should be taken from the roads budget and invested in public transport and whether government should investigate investment in new transport technologies like electric cars, the views of the community are significantly different to the way in which decision-makers believe the community thinks on these issues. These survey results highlight a mis-match between the values of the general community and those of key transport decision-makers.

Figure 2 Attitudes of the general community and transport decision-makers



Source: Glazebrook, G. 1997, *Community values: executive summary*. Sustaimable transport in sustainable cities project servies, Warren Centre for advanced engineering. University of Sydney, pp. 2–3.

This finding prompts the question, do people really love their cars or do governments just love road building? When asked, it is clear that people have many different reasons for using the transport modes that they do, but in aggregate it would appear the most compelling reasons people have are speed related and this is not something which they are responsible for setting, afterall it is governments and transport providors that play the decisive role in determining the supply of transport services and their relative speed.

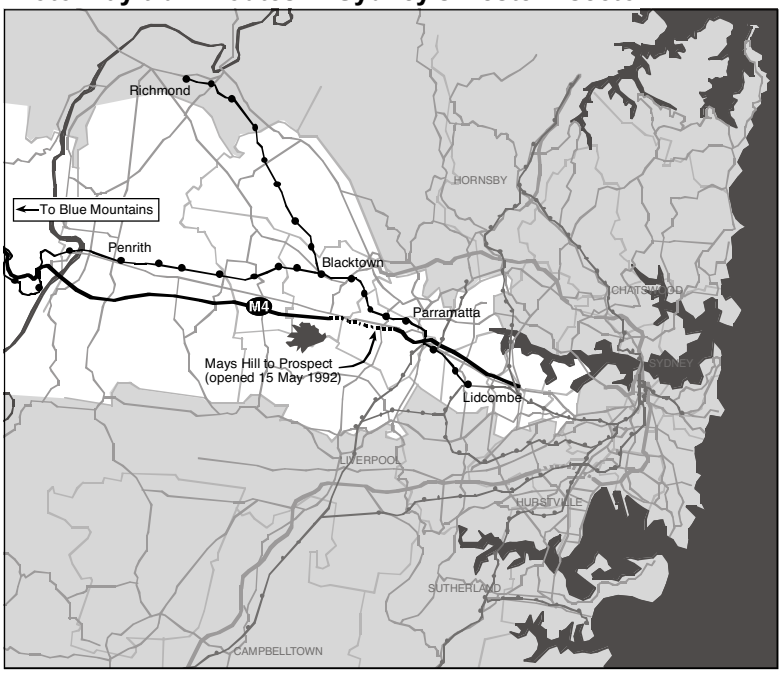
The next section examines changes to travel behaviour patterns before and after the opening of the M4 Motorway in Sydney. The data in this case study provides further insights into what people actually do by comparison with what popular commentaries and politicians say they do.

3. TRAVEL BEHAVIOUR RESPONSES TO CHANGES IN RELATIVE ROAD SPEEDS TRIGGERED BY ADDITIONAL URBAN MOTORWAY CAPACITY

The Sydney metropolitan area is served by a series of restricted access carriageways, or motorways. The motorways were originally planned in the early 1950s with most sections built during the 1990s and the early 2000s. These have a radial formation with most major urban sectors being served by a motorway with unrestricted access carriageways, or roads with drive ways and signalised intersections, and heavy rail lines also running along parallel alignments.

The M4 motorway serves the western sector of the Sydney metropolitan region, which is also served by the Great Western Highway and the Western Sydney Rail Line. The relative alignments of these major transport routes are shown in Figure 3.

Figure 3 Rail and motorway trunk routes in Sydney's western sector

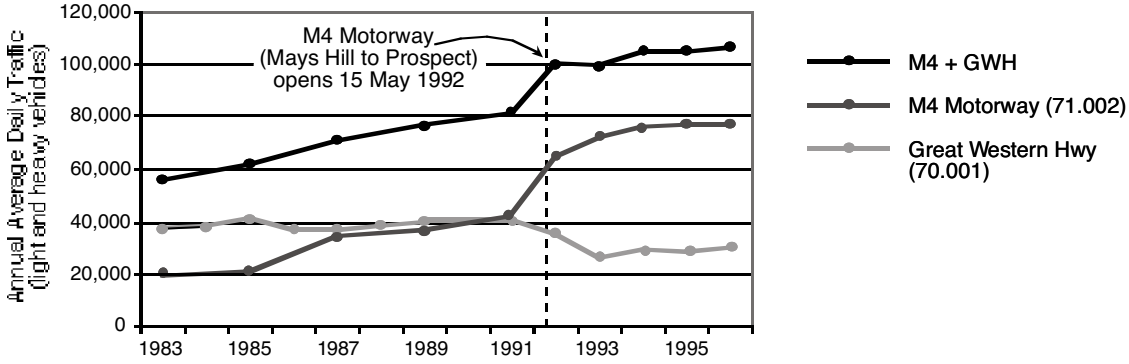


Source: Zeibots, M. E. 2007, *Space, time, economics and asphalt: an investigation of induced traffic growth caused by urban motorway expansion and the implications it has for the sustainability of cities*. Doctoral dissertation. Institute for Sustainable Futures, University of Technology, Sydney, p. 247.

Figure 3 also shows the position of a section of motorway that was opened to traffic in May 1992 from Mays Hill to Prospect. The time series data in Figure 4 show Annual Average Daily Traffic (AADT) volumes before and after opening of this section of the M4 Motorway and the Great Western Highway. These are shown in grey while the total for both roads is shown in

black. As can be seen, after opening of the motorway section there is a distinct increase in combined traffic volumes. Traffic engineers refer to this as the *ramp-up period*, which is the result of a range of different travel behaviour response that take place as a result of changes in relative travel speeds afforded by the additional road capacity (Luk and Chung 1997).

Figure 4 AADT traffic volumes before and after opening of the M4 from Mays Hill to Prospect (1983–1986)



Source: Zeibots, M. E. 2007, *Space, time, economics and asphalt: an investigation of induced traffic growth caused by urban motorway expansion and the implications it has for the sustainability of cities*. Doctoral dissertation. Institute for Sustainable Futures, University of Technology, Sydney, p. 221.

The data suggest that some of the traffic that had been using the Great Western Highway before the new motorway section was opened switched to using the M4 once relative traffic speeds had increased and congestion levels reduced. This travel behaviour response is referred to as *traffic reassignment*. However, the combined total increase in traffic is greater than the reduction in traffic volumes on the Great Western Highway, so there must be other sources involved.

There are several other responses that can be triggered by changes in relative travel speeds. These include:

> **Trip rescheduling**: where the increase in road capacity may also reduce congestion during peak travel periods and so encourage some people who had scheduled their trips outside the peaks to change their departure time, thereby increasing peak period traffic volumes.
> **Change in vehicle occupancy rates**: where some commuters who were travelling as a passenger in another's motor vehicle may choose to drive their own car.
> **Mode-shifting**: where people find that travel by car on a new or improved road is able to provide a faster trip than using parallel rail or public transport services and so shift from one mode to the other.
> **Trip redistribution**: where changes in prevailing travel speeds may also mean that preferred destinations that had previously taken too long a time to access fall within reasonable travel time budgets, inducing people to travel to more distant destinations.
> **Induced** or **generated trips**: faster network speeds may also result in people choosing to make more trips as part of their standard travel routine or undertake regular trips where before they had not travelled at all
> **Development traffic**: where districts that were once inconvenient to access because journeys times were too long may become more attractive as places to settle once a network has been augmented with new capacity (SACTRA 1994, pp. 20–22, 51 and 53).

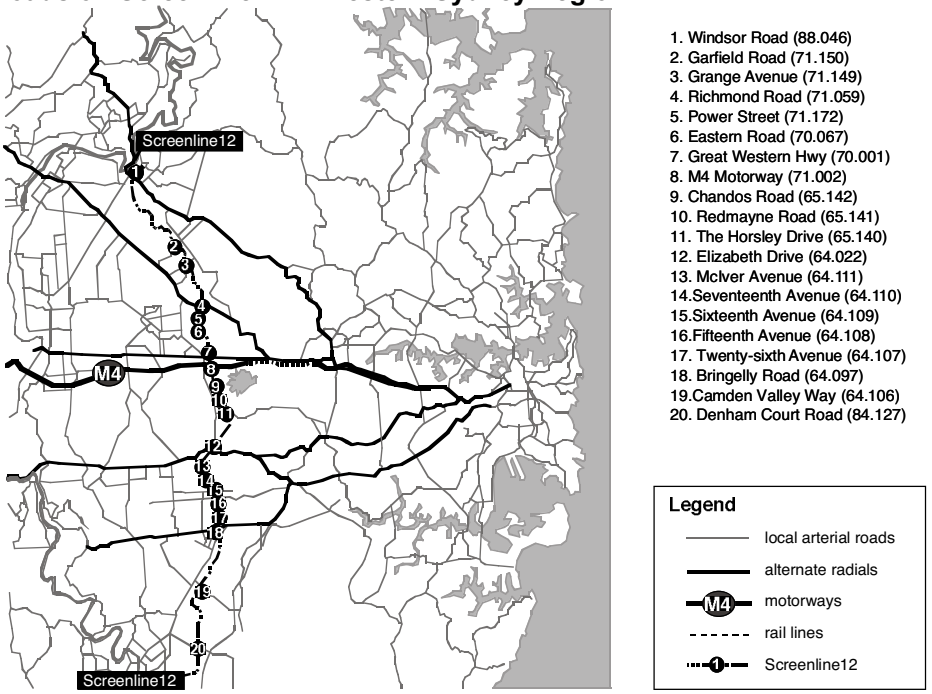
The last five types of response are significant in that they mean there has been an increase in the amount of travel overall, or vehicle kilometres travelled (VKT) on the road network.

Such an outcome can mean that a new road *induces* additional traffic that will create greater amounts of air pollution and fuel consumption rather than less. This has significant implications for the sustainability of urban systems. In the case of the M4, the increase in traffic that is above regular growth trends is in the order of 18,000 AADT movements between 1991 and 1992 (Zeibots, 2007, p. 221).

When undertaking induced traffic growth case studies such as this, traffic engineers construct something they call a screen line as a way of monitoring general traffic flows across an entire urban sector. A screenline is a conceptual line that attempts to capture general traffic flows from a broadly similar set of origins and destinations like the eastern side to the western side of a metropolitan area. Screenlines are constructed as a way of monitoring traffic reassignment where multiple routes could be used by people for their trips. In this case, it is possible that traffic not only reassigned from the Great Western Highway, but other more distant roads in the sector which could account for 18,000 AADT increase.

Figure 5 shows the location of 20 roads along Screenline12, which was identified by the NSW Roads & Traffic Authority (RTA) as a way of monitoring regional traffic flows through the western sector Sydney. The four arterial through-roads that potentially provide alternate routes to the M4 are highlighted in black.

Figure 5 Roads on Screenline12 in Western Sydney Region



Source: Zeibots, M. E. 2007, *Space, time, economics and asphalt: an investigation of induced traffic growth caused by urban motorway expansion and the implications it has for the sustainability of cities*. Doctoral dissertation. Institute for Sustainable Futures, University of Technology, Sydney, p. 223.

When traffic reassignment from these routes is taken into account, it can be seen that between 1991 and 1993 an additional 8,100 AADT movements is likely to have shifted from Windsor and Richmond Roads to the north of the M4 and Elizabeth Drive and Bringelly Road to the south (Zeibots, 2007, p. 240; Ian Wallis & Associates 2009, p. 33). There is also the need to take into account what has been called *natural growth* rates in traffic. This comprises traffic increases that would likely have occurred without any increase in capacity. These are estimated as being in the order of 4,500 AADT movments across all roads in Screenline12 (Ian Wallis & Associates 2009, p. 33). This leaves a remaining 11,900 AADT movements between 1991 and 1993 that could comprise induced traffic growth, representing 7 per cent of the total traffic through the 6 routes on Screenline12 prior to the section opening and 38

per cent of the total increase in M4 traffic between 1991 and 1993, or 41 per cent of the total increase in traffic after adjustment for underlying trends (Ian Wallis & Associates 2009, p. 33).

The other possible source of additional road traffic is mode shifting, or people who were using parallel train services shifting to private car use after the road network was made quicker. This portion is estimated to be between 6,000 and 2,500 of the AADT volume (Zeibots, 2007, p. 251 – 256).

More detailed analysis show that most of these responses occurred in a relatively quick time period after opening — within a few months — highlighting the significance of relative speed in determining travel choices (Zeibots, 2007, p. 257–259).

Given the general question asked at the outset of this paper, the key points that arise from this case study of the M4 section from Mays Hill to Prospect are:

- Changes to relative travel speeds are able to generate significant and relatively rapid travel behaviour changes on urban transport networks.
- These changes in actual travel behaviour correlate with attitudinal surveys relating to people's conscious motivations for travel choice.
- While individual drivers respond to changes in relative speed, they are not directly responsible for the decision to build a motorway or build a new rail line for example that is responsible for the changes in speed.
- If decision-makers continue to increase road travel speeds relative to those of public transport, then

The next section briefly investigates the consequences of decisions to build more road space in cities and the sustainability implications that such decisions have.

4. URBAN MOTORWAY DEVELOPMENT AND ITS SUSTAINABILITY IMPLICATIONS

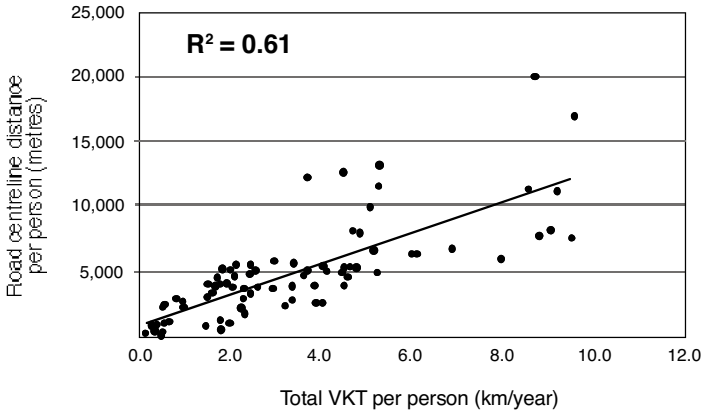
As shown in the previous section, when one section of urban motorway is opened to traffic it can lead to the generation of additional traffic. This raises the question of what happens to a city where multiple additions of road capacity are made to the urban network?

Figure 6 shows results from an empirical analysis of cities that compares the total amount of road space with the total amount of VKT per capita. As can be seen, in those cities where the amount of road space is higher on a per person basis, the amount of driving per capita is also higher.

In cities where the amount of driving is higher on a per capita basis, GHG emissions and energy consumption is also higher. How these cities came to be in this situation is a product of the multiple decisions made to increase and extend their road networks.

As stated above, these decisions — and consequent outcomes — are not the result of individual preferences, but rather the preferences of transport decision-makers and the values they use when determining transport policy.

Figure 6 VKT vs. road length per capita for 78 international cities (1995)



Note: Road capacity is measured as centreline road distance and not centreline *lane* distance, due to data availability. The latter would be a more accurate measure of operating capacity.

Data source: UITP 1995, *Millennium Cities Database.* International Association of Public Transport Providers (UITP), Brussels.

This raises another important question: if alternate public transport networks were made faster than access on the parallel road networks, would more people shift to using these? In which case, would there be a reduction in VKT, GHG emissions and fuel use?

5. CONCLUSION

The key conclusion to be derived from this overview is that government transport planning institutions play a primary role in determining what kind of transport infrastructures are provided in Australian cities and through this, they determine the relative speeds and levels of network coverage that individuals will then respond to.

If it can be accepted that the majority of individual commuters will select whichever mode is quickest when making their travel choices, and government planning authorities are responsible for determining which modes have the highest relative travel speeds, then it should also be accepted that governments are primarily responsible for general outcomes rather than individual commuters.

This conclusion highlights the importance of *planning* in transport decision-making and the responsibility that government has in initiating the direction that this will take. Achieving more sustainable outcomes in the Australian transport sector would appear to require greater education of transport decision makers than the general community.

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7. BRIEF BIOGRAPHY AND PHOTO

Dr Michelle Zeibots is a transport planner, specialising in the analysis of sustainable urban passenger transport systems. Her research and consultancy work draws together operational, behavioral and administrative aspects of urban transport networks. Originally trained in architectural design science at the University of Sydney before undertaking post-graduate studies in urban systems at the Institute for Sustainability and Technology Policy at Murdoch University, Michelle joined the Institute for Sustainable Futures at UTS to carry out doctoral research on induced traffic growth in 1997. She now works as a Senior Research Consultant with the Institute where she supervises PhD students and carries out contract research work for industry, government and the community.

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Dear Delegates,

On behalf of the Conference Organising Committee, Victorian Chapter and National Board of the Society for Sustainability and Environmental Engineering (SSEE), we warmly welcome you to the biennial SSEE International Conference in 2009. The primary theme for SSEE 2009 is "Solutions for a Sustainable Planet", since we firmly believe in the need for engineers and our associates to promote our solutions and get on with the tasks at hand.

The event has been co-organised with Engineers Without Borders (EWB) Australia, who have their annual conference in Melbourne immediately after SSEE 2009 from 26th to 28th November. The SSEE 2009 Committee are proud to support EWB and believe they are a critical part of meeting our conference theme – Solutions for a Sustainable Planet. The continued growth and success of EWB Australia is an inspiration, and we are pleased to partner with them for SSEE 2009.

This is the second time that the SSEE Conference is organised as an international event, and is part of a growing trend of international conferences in this important area. We have sincere pleasure welcoming our overseas delegates to Australia, and Melbourne in particular. We are confident that you will have a wonderful time during your stay in Australia and will take home some great memories of the Conference and its delegates.

The technical program is enriched with a number of impressive key note speakers and high quality presentations – both oral and poster – on a range of topics including the built environment, cleaner production, energy, climate change, sustainability theory, infrastructure, waste management, transport, water and others. Collectively, they build on the growing body of expertise within engineering and broad interest in environmental and sustainability issues. All contributions were selected after a thorough review of abstracts by at least two subject experts. If authors wished, full papers were also peer-reviewed before final acceptance.

We are delighted to present a thumb drive or 'USB' of the conference proceedings, which includes conference information, peer-reviewed and non-reviewed full papers, extended abstracts and abstracts.

The four days of the Conference are filled with a number of programmes in addition to the technical presentations, which include the technical tours, and welcome reception on Sunday 22nd November, the Conference Dinner on Monday 23rd November. On Wednesday 25th November we have a range of technical tours to highlight local examples of where and how engineers and our associates are meeting the challenge of sustainable solutions – demonstrating the tried but true saying of "think globally, act locally".

A number of organisations have sponsored the Conference at different levels and we thank our sponsors for their support in one of the most uncertain and difficult economic periods in recent memory. In particular we acknowledge the Victorian Department of Industry, Innovation & Regional Development (DIIRD) for their strong support as our Global Sustainability Sponsor and assistance with the conference; Synergetics as our Sustainability Analysis Sponsor; New Zealand Society for Sustainability Engineering & Science (NZSSES) for sponsoring Dr Carol Boyle; and VicRoads for sponsoring Daniel Almagor (Engineers Without Borders).

We believe not only in talking about sustainability, but that it is implemented in our own Conference. We followed and enhanced, where possible, the guidelines from the SSEE 2007 conference (shown page 8).

This Conference would not have happened without our dedicated organising committee members. These volunteers met regularly for 2 years – despite heavy workloads from consulting, academic or industry jobs (or even part time graduate study). Long distances over oceans could not even hold back some erstwhile committee members from joining meetings via telecommunications – often despite weird time differences. Without the committee's consistent, dedicated hard work this conference would not have been remotely possible.

Thanks to Engineers Australia, particularly the Victorian Division, for promoting the Conference through their newsletter and emails.

The biggest thanks go to all delegates, without whom there would not be any Conference at all ! We hope you will learn a great deal at this conference, be inspired to take positive action, and be able to share your knowledge and experience with one another and go on to implement many of the sustainable solutions from the conference in your own professional activity and organisations.

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All conference presentations, either oral or poster format, were selected through the submission of an initial abstract. After peer-review of abstracts, authors were approved for either an oral presentation or digital poster. At this time, authors could choose to submit a full paper or extended abstract, and have this peer-reviewed, or reviewed only by technical committee. All papers are carefully labelled with respect to their review and presentation status. The hard work by all members of the abstracts and paper review teams is sincerely appreciated (and acknowledged individually below).

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Do People Really Love Their Cars or Do Government's Just Love Road Building ... and What are the Implications for Sustainability?

- Dr Michelle Zeibots, Institute for Sustainable Futures, University of Technology Sydney

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When confronted by problems like traffic congestion, amenity impacts and the need to curb greenhouse gas emissions, various transport commentators will state that 'people love their cars'. The rejoinder to such claims is that nothing much can be done to change the high levels of car-use in Australian cities or reduce the consequences of this and that community attitudes are to blame for this.

This presentation confronts this view by first examining actual travel patterns in Australian cities where it is shown that the transport choices people make are highly dependent on the transport options made available to them - people can't use public transport if services have not been provided in their neighbourhood or are operating at poor service levels, but they clearly do use low-impact modes, and in large numbers, when networks and services are reliable and frequent. Significantly, it is not individuals in the community that are primarily responsible for the provision and state of these networks but rather governments and transport professionals. To better understand how the relationship between travel behaviour and infrastructure provision plays out, this presentation briefly examines the travel behaviour changes that occur after a new urban motorway is opened to traffic. Through use of a Sydney case study, it is shown that adding new road space generates a sudden increase in road trips often referred to as induced traffic growth. Commentary surrounding this event is also examined. That dramatic changes to road travel behaviour are triggered by road building decisions from governments provides a different way of approaching the issue of sustainability and the Australian transport sector.

The presentation concludes that achieving greater sustainability within the Australian transport sector - reducing impacts and solving transport problems - does not require changes to public attitudes, but rather, requires changes to transport decision-making processes and the understanding that transport practitioners and politicians have of the projects they advocate.

BIO:

Dr Michelle Zeibots is a transport planner and academic researcher at the Institute for Sustainable Futures at the University of Technology, Sydney. Michelle's current research focusses on the sustainability impacts of urban motorway development and induced traffic growth on cities. She recently presented evidence as an expert witness on induced traffic growth to the Frankston Bypass Inquiry in Victoria, where it was accepted for the first time that induced traffic growth needed to be included in traffic projections and greenhouse gas estimates for motorway proposals. While at ISF, Michelle has worked in a research capacity for government agancies in WA, Victoria, NSW and New Zealand on a variety of sustainable urban passenger transport projects.

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