

World Transport Policy & Practice

Volume 13, Number 2

**Dissecting
Bangalore Traffic**

**Sustainable
Transport in
Davis**

**A MEDIA ANALYSIS OF UK AVIATION
AND AIR TRAVEL STORIES**

**Unlocking the potential of
Site-based Mobility
Management through
Local Travel Plan Groups**

**Exhausting the city: Implications of
land use and transport in Perth**

© 2007 Eco-Logica Ltd.

Editor

Professor John Whitelegg
Stockholm Environment Institute at York, Department
of Biology, University of York, P.O. Box 373, York,
YO10 5YW, U.K

Mikel Murga

Leber Planificacion e Ingenieria, S.A., Apartado 79,
48930- Las Arenas, Bizkaia, SPAIN

Paul Tranter

School of Physical Environmental & Mathematical
Sciences, University of New South Wales, Australian
Defence Force Academy, Canberra ACT 2600,
AUSTRALIA

Editorial Board

Eric Britton

Managing Director, EcoPlan International, The
Centre for Technology & Systems Studies, 8/10 rue
Joseph Bara, F-75006 Paris, FRANCE

Professor John Howe

Independent Transport Consultant, Oxford, U.K

Publisher

Eco-Logica Ltd., 53 Derwent Road, Lancaster, LA1
3ES, U.K Telephone: +44 (0)1524 63175

E-mail: j.whitelegg@btinternet.com

www.eco-logica.co.uk

Contents

Editorial	3
<i>John Whitelegg</i>	
Abstracts & Keywords	5
Sustainable transport in Davis	8
<i>Anders Langeland</i>	
Unlocking the potential of Site Based Mobility Management through Local Travel Plan Groups	23
<i>Dr Marcus Enoch, Mr Lian Zhang & Dr Stephen Ison</i>	
A media analysis of United Kingdom aviation and air travel stories	40
<i>Lisa Davison & Tim Ryley</i>	
Dissecting Bangalore Traffic	51
<i>Akbar & Sudhir</i>	
Exhausting the City: implications of land use and transport in Perth, Australia	78
<i>Ryan Falconer</i>	

Editorial

We are very pleased to announce that after several delays and interruptions to normal service we are now back in action and with a re-vamped web site. Please have a look at:

www.eco-logica.co.uk

You will find all issues of WTPP on this site, as well as details of other project work going on under the Eco-Logica banner.

2008 has been a fairly depressing year for sustainable transport watchers. We seem to be deeply entrenched in a policy cycle based on denial. We know that current transport spending and transport policies are adding to huge increases in greenhouse gases and climate change problems and yet we are not prepared to adopt sensible policies to reverse the trend. This is especially the case with aviation policy both in the European Union and globally. We know that our car-dependent life styles are adding to health and obesity problems with countries like Australia, the UK and the USA reporting about 25% of their populations as obese. In the UK this is estimated to cost about £45 billion pa. In the UK we still have ridiculous road projects like the Heysham M6 Link (HM6L) road that will cost over £150 million to build and destroy both countryside and peaceful living for many thousands of people. The road will also generate extra traffic and extra 24,000 tonnes of carbon dioxide each year.

It is extremely depressing to see the coincidence of lots of noisy projects like

airport expansion and the HM6L and new scientific evidence that shows a total of about 200 000 deaths from exposure to noise. Clearly the ability to fly further and cheaper for shopping trips to New York and to drive short distances by car for groceries has a higher value than human life and human health. You can see more about this on:

<http://www.newscientist.com/channel/health/mg19526186.500-dying-for-some-quiet-the-truth-about-noise-pollution.html>

On a global scale we are now looking at 1 million deaths per annum from so-called road traffic "accidents" which are in any case not "accidents" because they are so predictable and so easily prevented. We can add to this over half a million deaths from air pollution related diseases and 200 000 from noise. This really is a very bad deal for the species and the planet.

In this issue we return to some familiar themes that all contribute to our understanding of the way that land use and transport systems operate and in addition to presenting us with problems also present us with enormous opportunities to throw the levers into another position and create a virtuous cycle of progress.

Ryan Falconer's paper about land use and transport in Perth in Western Australia reminds us once again how powerful are the land use and urban structure inputs into the definition of transport problems. In most parts of the world a shaky awareness of the

importance of public transport, walking and cycling is undermined by a wild-west approach to land use. A “spread-out” city cannot be a sustainable city. Anders Langeland shows us just what can be achieved in a city that is better planned and organised. Davis in California is a very different “animal” to Perth in Western Australia but both illustrate some important relationships and principles that can be used to re-Engineer an urban system towards sustainability.

Akbar & Sudhir illustrate the complex road traffic issues facing Bangalore’s traffic system and carry out an analysis of the component factors which have contributed to the present day traffic situation.

Marcus Enoch takes us into the core of travel demand management and the opportunities that exist to reduce the demand for car trips and reduce car dependency. This powerful tool is well understood in the UK and where it is done well highly cost effective outcomes are achieved on a short timescale.

Finally we turn once again to aviation but this time focussing on the role of the media. In an important article Lisa Davison and Tim Ryley analyse the way the media has covered aviation and the fascination that most users have with this polluting mode of transport.

John Whitelegg
Editor



Abstracts & Keywords

Sustainable transport in Davis

Anders Langeland

In a case study of land use and transportation planning and policy in Davis the questions were posed: *To what extent is Davis transportation sustainable, and how has the city managed to develop differently than other cities?*

Davis is the US Bike City. The students and staff at the university use the bike far more than the ordinary residents of Davis. Davis has the basic infrastructure necessary to accommodate a shift from

the car mode to public transport and walking and cycling.

Transportation in Davis is far more sustainable than most comparable US cities, but still very car based. This paper provides a critical review of the City and its transportation policies, offering interesting lessons for European cities.

Keywords: Bicycle, Bike city, Transportation Policy, Subsidiarity

Unlocking the potential of Site Based Mobility Management through Local Travel Plan Groups

Dr Marcus Enoch , Mr Lian Zhang and Dr Stephen Ison

Travel Plans are potentially an important means by which excessive car use can be addressed. They involve traffic generators such as retail parks, hospitals and local authorities and are seen as a relatively cheap and uncontroversial measure that can be introduced in a targeted and site-specific manner. They are however predicated on these organisations being motivated embrace travel plans in helping to address a problem, for example congestion, which they may not see themselves as being the major cause of. One way of addressing the resistance of organisations to meaningfully adopt travel plans is for local authorities to set up some form of 'Local Travel Plan Group' (LTPG) or 'Network' offering organisations more influence as to how local transport decisions are enacted.

The aim of this paper is to detail the reasons why the widespread adoption of travel plans has failed to materialise and whether establishing LTPG's is likely to aid the situation. The paper classifies LTPG's, explores how they might be implemented and what type is appropriate in what circumstances. The paper is based on a review of existing LTPG's and their potential for effective policy transfer. The paper draws on research undertaken for the European Commission North West Europe Interreg IIB programme OPTIMUM2.

Keywords: Travel plan, Site based mobility management, Local Travel Plan Groups (LTPG)

A media analysis of United Kingdom aviation and air travel stories

Lisa Davison & Tim Ryley

United Kingdom media coverage is analysed, focusing on topical air transport extracts from newspaper coverage during 2006. The main analysis themes relate to the political dimension of the stories, the impacts of the August 2006 security alert, and the tension between the economic and environmental aspects of aviation. Article content varies by the type of

newspaper; for instance the mid-market tabloids tended to publish more personalised, one-sided articles. The findings show that media awareness is increasingly required by the aviation industry.

Keywords: Aviation, media, environment, United Kingdom

Dissecting Bangalore Traffic

Akbar & Sudhir

Bangalore has seen an amazing transformation from once being a Pensioner's Paradise, to Garden City and finally to the Silicon capital of India. The booming software, biotech and other industrial sectors have exerted tremendous pressure on the available infrastructure. When faced with such complex issues, the government took more supply-intensive actions instead of the necessary demand-based actions. In this paper the authors have attempted to critically dissect the issue of Bangalore

road traffic. Such an exercise is necessary due to the fact that numerous studies conducted in Bangalore have shown contradictory results and have not provided any relief in traffic levels. An attempt has been made in the following paper to analyse the components contributing to the issue of road traffic.

Keywords: Bangalore, BMTC, Traffic, Accidents, Vehicle Pollution, Sustainable Transportation

Exhausting the City: implications of land use and transport in Perth, Australia

Ryan Falconer, Professor Billie Giles-Corti, Professor Thomas Lyons

Following World War Two (WWII), land use and transport policy and practice in most major Australian cities were modelled on the US experience. As such, these cities have become characterised by segregated zoning, low development densities and car dependence. Car dependence is in turn linked to dependence on fossil fuels for transport energy. Increasingly, too, links are being found between conventional planning outcomes and public health. For

example, research has linked car dependence with a variety of health conditions, including overweight/obesity. This paper aims to deepen understanding of how post-WWII planning in major Australian cities, particularly Perth has created a need for policy redress. Using a broad understanding of transport sustainability it explains how conventional planning outcomes and preferential car use are increasingly considered to be unsustainable. Finally,

the paper pulls the pieces together to suggest that the increasing recognition amongst policy makers that many of our cities are being 'exhausted' is why new planning suites, such as Perth's "Liveable Neighbourhoods" (LN) and behaviour change strategies, such as Travel Smart are being applied. Significantly, these policy approaches are tailored to the Perth context although they share

principles with other measures for reform, such as Smart Growth. It is now important that these new strategies are evaluated and re-informed by research.

Keywords: Perth, car dependence, sprawl, choice, transport sustainability, policy reform



Sustainable Transport in Davis

Anders Langeland

Introduction

The City of Davis is the *US Bike City* (Bicycle Magazine 2003) and some have even called it The Bike City of the World (Lofland 2004). Thinking that there was no place for environmentally friendly modes in the US, Davis with an abundance of bikes (but also huge SUVs and trucks) with local well-functioning bus services and quite a few trains daily, forced me ask questions. Was it a result of deliberate policies and actions, or did it just happen? When so many cities struggle to get people to use soft modes like walking, cycling and public transport (PT) how did Davis manage to become a biking city and what role did land use and transport planning play?

Research question and method

This study of sustainable transportation in Davis focuses on several key questions:

- *How was the land use and transport connection in Davis? What effect had planning and policy on the choice of transport mode? Was the development caused by a deliberate policy and was it sustainable?*
- *How could the observed land use and transport development be explained? What were the factors facilitating cycling and what were the factors inhibiting more sustainable transport development?*
- *What if any, are the lessons from Davis for medium sized cities in Europe?*

The paper outlines firstly the theoretical context and the method used in the case



study. In the next section a description of Davis follows and change in mode choice over time is shown. In the third section Davis is analysed, focusing on sustainable transport. I have chosen to evaluate the historical development in Davis to find the reasons why Davis has managed to develop the bike city.

Lastly, I return to the three questions posed and draw some conclusions and lessons for European cities.

Theoretical context – The gap between policy aims and city transportation reality

Urban sprawl and increasing car dependence is a major issue in many countries. Recently there has been an increasing gap between our ability to govern and city expansion. Angela Hull stresses the role of institutions in delivering land use and transport policy: "*Two recent pieces of research evaluating the delivery of more sustainable transport solutions in the UK have drawn attention to the regulatory abyss and the institutional fragmentation of policy makers and public transport providers in the UK*" (Hull 2003). Delucchi et al. (2002) points out that it is "impossible" to close the gap between policy aims and visions on the one side and the real world where people buy more and more cars on

the other side: *"When people get wealthy, they buy cars and live in bigger homes further away from central cities. In an era of rapidly expanding personal mobility, cities have been constructed and reconstructed for fast, heavy motor vehicles. Nothing short of outright prohibition or economic catastrophe – not high gasoline prices, not better public transit, not better zoning – will stop this trend."* Sheller and Urry remark that: *Automobility has fragmented social practices that occurred in shared public spaces within each city. In particular, automobility divides workplaces from homes; it splits homes and business districts and separates homes and various kinds of leisure activities. Automobility turns access zones on urban fringes into wastelands.* (Sheller and Urry 2000: 744) David Begg (Commission for Integrated Transport, 2001:24) worries about the future: *"Today we all stand at a crossroads between a US-style car culture and a sustainable European multi modal system. The decisions we take now and the levels of investment that we attach to them will determine where we end up."* This challenge from increased car dependence is shared in most cities; see for example Pucher and Lefèvre, *The Urban Transportation Crisis*, and the UN-Habitat report, *The State of the Worlds Cities 2004/2005*.

The role of land use and transportation planning

Land use planning has responded with ideas like New Urbanism, Smart Growth and in Europe: Integrated land use and transportation planning. Common to these ideas are mixed land use instead of zoning, higher density and designing cities instead of designing suburbs, and Transit Orientated Development (TOD). TOD is commonly defined as mixed-use,

relatively high density, pedestrian orientated district that is located within half a mile of a rail, bus or ferry station. Furthermore the urban environment must encourage and or facilitate transit use and walking through its urban form. (Renne 2004)

The failure to integrate land use and transportation planning is often related to fragmented policy institutions and lack of intergovernmental co-operation. Hull as stated above, even use such a strong word as an abyss to describe the situation in England. Still there seems to be a wide agreement that land use and transport planning is a very important instrument to deal with the sustainability issues and better quality cities (Næss, 2006).

Sustainable transportation in cities

The sustainable development discussion started with the Brundtland Commission report *'Our Common Future'* which defined sustainable development: *"To meet the needs of the present without compromising the ability of future generations to meet their own needs."* This definition opens up for very broad interpretations. In this paper the more narrow concept of environmentally sustainable transport (EST) as defined by OECD is used: *"Transportation that does not endanger public health or ecosystems and meets mobility needs consistent with a) 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."*

We also set a distinction between sustainable transport systems and sustainable mobility. The mobility of people has to be adapted to the carrying

capacity of an environmentally sustainable transport system (Høyer 1999). A sustainable transport system – in the long term – is one consisting of components “driven” with sustainable energy supply. However, the depletion of fossil resources continue, biodiversity continues to be reduced and the emissions of CO₂ and other greenhouse gases keep increasing (EEA 2006). The premise for the study is that the level of mobility should and must be adapted to the carrying capacity of an environmentally sustainable transport system.

Case study methodology

This paper is part of a multiple case study limited to medium sized cities: urban areas between 50 and 300,000 inhabitants. The focus is on person transport and the effects of the instrument or tool land use and transportation planning, programmes and policy.

The key indicators are:

1. Trend in land use and density, person kilometre travelled, consumption of fossil resources, emissions
2. Mode share (car, PT, walk, cycle)
3. City land use and transportation policy: aims, measures, outputs and outcomes.

In the following the “level of unsustainability” or the best practices among comparable cities are assessed:

- High share of walking, cycling and public transport usage.
- Infrastructure supporting these three modes of travel.
- Land use policies that increase densification (dwellings/hectare) and limit urban sprawl

- Social cohesion and accessibility in an area require Public Transport at a certain level of service that gives a minimum standard of access to the city centre (accessibility to other parts of the city should ideally also be above a minimum standard, but that seem utopian in most cities due to the costs of providing public transport low level of demand distributed spatially) for those without access to a car.
- Policies that
 - a) Support car sharing, car pooling, etc.
 - b) Promote walking and cycling
 - c) Use parking as an instrument to reduce the use of cars
- Gaps between policy aims and actual development

Lack of integration of land use and transport policy across levels and layers is often a major problem (Beatley 2003). Planning and implementing of such policies are dependent on several actors and agencies cooperating, for example the planning office, the road engineers, consultants and highway authorities. Each of these have vested interests, ideas of how things are done and indeed a knowledge of institutions and processes, which may be used to set up barriers to all policies that do not suit their interests. (Bijker et al. 1987, cited from Tengström 1999:23)

Planning and Action has been a theme in the planning debate for decades. A conformance view treats the effectiveness of plans or strategies as goals achievement. The Dutch school on the other hand says that the performance of the plan is important, not the result. Plans have effect during the planning process, and plans can perform well without influencing actions (see

Alexander and Faludi 1988). In this case study I try to use both the conformance and the performance view, when analysing land use and transport planning.

The output of land use and transport policy is the decisions on visions and goals and the strategy to reach these goals. This may be called formal policies, and are of secondary interest in this paper. The outcome of land use and transport policies are decisions on budgets and instruments to be used to implement the policy. This may be called *Realpolitik*, and are of prime interest in this paper (Flyvbjerg 1998).

Data

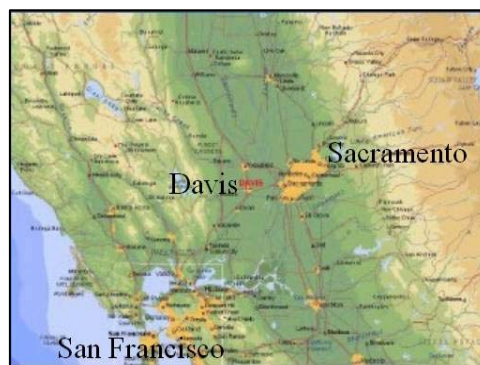
Cities are not static, but dynamic “engines” in urban and national development. This continual change and evolution of urban structures makes static analysis difficult.

Data on key indicators to follow change over time is often hard to come by. It is often necessary to construct “pictures” from data from many sources and estimate missing data. One example is the mode share data cities use to present themselves. If the data source is a travel survey based on telephone interviews with a representative sample of an area (e.g. Sacramento Region), it becomes less representative when used only on a part of the same area (e.g. City of Davis). In many cases, however, the mode share data is calculated from short traffic counts (often a few days and calibrated to AADT - Annual Average Daily Traffic) multiplied by average vehicle occupancy (often fetched from historical data) and presented as figures for a particular area, for example the city or the city centre. It is important to be

aware of how mode split data have been produced, when such data is being used.

Sustainable transport in Davis?

The city of Davis is a quiet idyll in an expanse of agricultural land. A “one-company” town 20 km from the state capital of California, Sacramento, the company being the University of California Davis (UCD.)

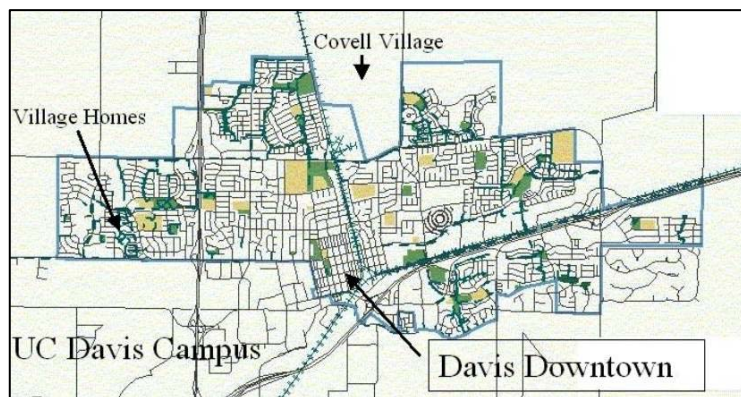


The location of Davis

The city of Davis is 25 km² in area and has 64,000 inhabitants, a slight decline in population occurred in 2004. Over the last ten years the annual growth has been on average 1.7%, most of this strong growth came in a few years.

The City of Davis presents itself as “the Bike City” and has chosen to use “The Penny-Farthing” or the velocipede as the city logo, giving one aspect of the city identity (Declared America’s Best Cycling City 1995 by the Bicycle Federation of America). Indeed some have called it the Bike City of the World (Lofland 2004). The Bike City was fought through by a group of citizens in the sixties, against strong opposition from the City Council, city administration and the police. It required an election in 1966 for the bike

proponents to win, but then all doubts were put aside and the new council introduced bike lanes on all roads where possible.



Map of Davis

Davis has a grid system with 80 ft (about 24m) wide roads, therefore all the city had to do was paint new lines in the streets to create the bike lanes, (although exemption from the state regulation on road markings was necessary). But the city went further and said that bike paths should be built in all new developments and the bike network should connect to all schools, green belts, paths and the city centre. A bike transportation strategy was created.

UC Davis is also taking care of the bike heritage!

The City of Davis borders with the UCD campus, but has no jurisdiction over the campus area even though it is difficult to see where the downtown of the city stops and campus begins! UCD is a separate jurisdiction and has its own police force, road maintenance staff, planning department, etc. At present there are about 28,000



students and 18 000 faculty and staff in total on UCD. House prices in Davis are high and increasing fast. "The faculty can't afford to live in Davis" is how the UCD planning director put it (Interview Robert Segar, 06 May 2005). The housing problem is also enlarged by external demand. "Davis has become a "Dorm City" for Sacramento and also the Bay Area" said the city planner (Interview with city planner Bob Wolcott, 28 April 2005).

Davis modal split

The Davis urban area that has a sharp border against the surrounding agricultural area is divided in two jurisdictions, the City of Davis and UCD. Each of these jurisdictions has different aims and tasks. There are no common statistics for Davis urban area or common studies looking at the area as one unit. In this section we have therefore used the available data and studies to produce a picture of travel in Davis and how these trips are shared between the different modes of travel: car, public transport, walking and cycling.

UC Davis, Housing and Transportation Survey 1988

UCD employees residing outside Davis are very car dependent (97% of trips). Nearly half of the UC Davis employees, who also lived in Davis in 1988, used the bike for the work trips (45%) while 4% walked. Public transport was used by less than one percent. Only 51% of the UC Davis employees residing in Davis used the car for the trip to work.

UCD mode split among employees 1988

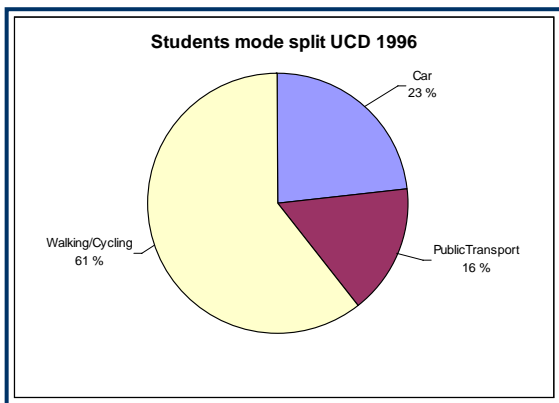
Mode split 1988	UCD employed	
	Davis residents	Outside Davis residents
Percent of trips		
Car	51	97
Public transport	0.5	0.9
Walk	4	0.1
Bike	45	1.3
	100	99

Source: UC Davis, 1988. Housing and Transportation Survey. Arthur C. Lowe, Planning and Budget Office

UC Davis campus survey 1996

A 1996 campus survey at UC Davis showed that 60% of the students either biked or walked, and 20% of faculty and staff walked or biked, averaging 15,000 to 18,000 bikes on campus each day

Mode split at UC Davis 1996



(Toor 2004:193). Both groups compare very favourably with the figures for the US as shown in the national census data where 88% used the car for the work journey (US national census data 2000. Source: Will Toor and Spencer W. Havlick. 2004: 131.).

Sacramento Region – Household Travel Survey 2000

In the Sacramento Region the car is used for more than 90% of the trips, walking 5%, but public transport only 1% and bike 2%. This is typical pattern for most regions in California. Both the City of Davis and UCD come out very favourably

in this survey. The car is still the dominant mode for UCD residents with 53%, but 24% cycle, 16% walk and 7% use public transport.

Mode share for all trips, Davis, UCD and Sacramento Region

Mode split 2000	Davis	UCD	Sacramento Region
Car	75	53	91
Public Transport	1	7	1
Walking	10	16	5
Cycling	12	24	2

Source: Sacramento Region Travel Survey 2000. Analysis of the 2000 SACOG Household Travel Survey. Prepared by DKS Associates for Sacramento Area Council of Governments

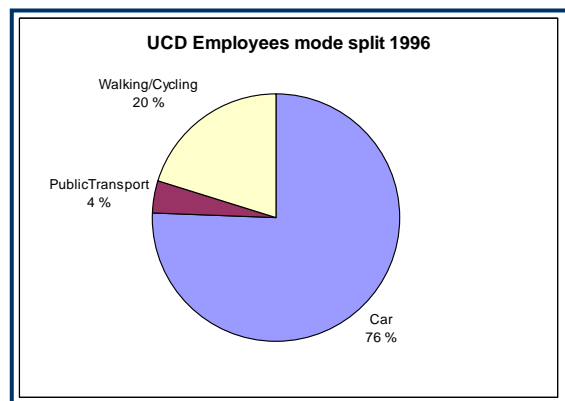
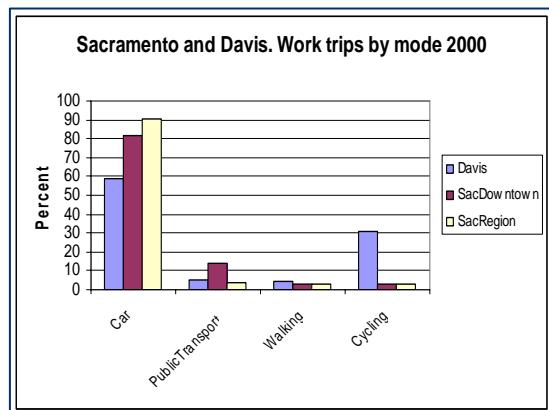


Figure 5 shows the journey to work by mode for Davis City, Sacramento Downtown and Region.

Figure 1 Sacramento and Davis. Journey to work by mode 2000



It is the use of the bike that makes Davis most sustainable of the three areas. This is a result of 40 years of bike policy in Davis and the very active policy of the neighbouring jurisdiction UCD. Both Davis and UCD have an active policy promoting the use of bicycles, they have invested heavily in the bike infrastructure and run a Transport Demand Management programme.

Important land use and transportation events in Davis

The development of land use and transportation in Davis can be looked upon as two parallel intertwined processes, the City Council policy and the UCD policy. The people of Davis have contested growth through decades. Land use and transportation planning and policy are the instruments used by the different groups to achieve their ends. Cases lost often crop up again and influence other cases at a later stage. The development process has been complex but there is a clear course through the history which we will show in this chapter. Underlying the day to day issues and decisions are major questions about the future of Davis: *"Almost everyone in town agreed that Davis should grow slowly, recognising that at some point its roads would become overcrowded, bicycling around town would become difficult, crime would approach big-city proportions and the community would face other ills typical in larger cities. Perhaps most alarming was the notion that Davis might lose its small-town character without even realising it."* (Fitch, 1998: 74) But how much growth is slow growth? Over the years the opposition groups have developed excellent skills in fighting development plans, obviously having had

professional help from UCD employees. There is a two sided feeling about growth. On the one hand UCD must grow to keep the city economically healthy yet on the other hand, there is the NIMBY effect (not in my back yard) and the worry that big developments will damage the city as one opposition group puts it: *"Good cities are rare! Let's not rush to lose ours!"* (Source: Wildhorse Opposition Association in its literature during a 1995 referendum over a 425-acre project – Fitch 1998). In this section, we highlight the course of events and issues that have had a deep and lasting effect on the land use and transportation development of the City of Davis. Following the course of events requires detailed research into the land use and transportation planning processes. However, highlighting some events does not therefore mean that daily practice with applications, proposals, plans and decisions are thereby forgotten.

The major land use and transportation events have been:

- The Bike City 1966
- Village Homes 1975-82
- The General Plan and the Bike Plan 1987
- Pass Through Agreement 1987
- Alternative Transportation Task Force – ATTF 1994-96
- The 2000 Measure J.
- The General Plan and the Bike Plan 2001
- Covell Village 2005

The Bike City 1966

The Bike City was fought through by a group of citizens, against strong opposition from the City Council, city administration and the police. At the election in 1966 the bike proponents

won. The City Council decided that bike paths should be built in all new developments and the bike network should connect to all schools, green belts, paths and Downtown. A bike transportation strategy was created. (Lofland 2004:131)

Village Homes

Davis likes to talk of itself as the Eco City, an understanding that goes back to the seventies and the famous development Village Homes. The principles behind the design of the community are ecological and sustainable development. The design focuses on walking and cycling by locating paths in green, communal and well used areas. The bike paths are connected to the main bike network. The idea behind the design was to support other modes of transport in favour of cars. This ideology has fully supported the use of environmentally friendly transport in Davis.

The process of developing Village Homes in the seventies was met with opposition. "The staff objected to the narrowness of the streets, the inward-facing houses, and the long cul-de-sacs. The fire and police chiefs objected to the layout and worried about access for emergency vehicles. The entire process taught us that change must originate with local elected officials. Local authority employees put a lot of energy into doing things the same way as they did them yesterday." (Corbett and Corbett, 2000:25). Thirty-two banks and loan institutions refused to finance Village Homes and the design was ridiculed in some circles (The Bank of America did not turn down the loan because of the economic risks involved, "they simply found the project's philosophies distasteful." Corbett 2000:26). Once built, it became an icon for eco-friendly

housing development and attracted visits from famous people such as President Carter's wife, President Mitterand and Jane Fonda. The Village Homes ideology took into account the environment, the use of renewable resources and the use of land and water. The design recognised the car whilst minimising the provision allocated to the private vehicle. It used the pedestrian and cycle paths as the central transportation element to promote the use of the bike, a design which comes close to the present term "sustainable design".

A measure to prevent sprawl – *The Pass Through Agreement*

In 1987, the City of Davis and the County of Yolo executed a 'Pass Through Agreement', in response to the city's redevelopment plan. The agreement ensured that the city would literally "pass through" specified property tax increments to the county. This agreement is conditioned upon the county not approving urban development within the city's planning area without city consent, thereby avoiding 'leap frog' growth or growth which is difficult to service. This agreement has been very effective in containing the expansion of Davis and is the main reason that shopping centres and other developments have not cropped up along the city's edge. Recently, Yolo County have asked to renegotiate the economic terms of the agreement (Davis Enterprise May 24th 2005).

The General Plan & the Bike Plan '87

As part of the General Plan review in the mid eighties, Davis produced the first comprehensive Bike Plan which confirmed the twenty year old policy for establishing a comprehensive network for walking and cycling covering the whole city together with good access to major

traffic generators. The Bike Plan also recognised that the bike infrastructure alone was not enough to make people use the bike in competition with other modes. The plan called for a bicycle promotion policy to inform the public and create awareness of the positive effects of using the bicycle (Tim Bustos was employed full time as the City of Davis Bicycle and Pedestrian coordinator and UCD followed up and employed David Takemoto-Weerts as the UCD Bicycle coordinator).

Alternative Transportation Task Force – ATTF

The City Council set up the Alternative Transportation Task Force 1994 (UCD Institute of Transportation Studies was founded three years before in 1991) and charged with exploring *“the potential for increasing the use of transportation modes that provide an alternative to the gasoline or diesel fuelled automobile.”* The task force recommended: *“systemic changes to land use planning and transportation systems, as well as specific short-term improvements that would enhance bicycle, pedestrian, electric vehicle and transit transportation”*.

Most of the recommendations were adopted in the General Plan in 2001.

“Measure J” 2000

Growth has been a contentious issue throughout the city’s history. Between 1950 and 1987, the yearly population growth was an incredible 6.4% (Bike Plan 2001, page 1). The City Council, which has five elected members on a non-partisan vote, adopted “Measure J” and put the proposal before the electorate in 2000 (In March 2000, 54% of voters approved a Council-proposed measure

requiring a “vote of the people if the City Council approves development on land outside of city limits”). The measure says that any council decision on annexation of land for urban development must be put to the population for a ballot. This measure became decisive in the Covell Village development proposal, as we outline below.

The General Plan and the Bike Plan 2001

The General Plan and the Bike Plan of 2001 are in essence a similar set of plans from 1987 rolled forward, but with more emphasis on walking and cycling. The plans were strongly influenced by the ATTF. Tim Bustos the City of Davis Bicycle and Pedestrian coordinator describe the effect of the plans thus (Interview with Tim Bustos, May 20th 2005): *“Bicycle transportation is institutionalised in the General Plan. The city adopts the policy of bicycle travel in new developments ensuring links to existing trip generators (standards and design guidelines). Good lanes and paths and most importantly, good connections both in communities and along arteries.”*

Covell Village

Covell Village (Designed by Michael Corbett, the designer of Village Homes), a 160 hectare area which was proposed to be developed with about 1,600 houses was the first proposal to be put before a ballot in November 2005. The city administration were strongly in favour of developing Covell Village (Judged from statements in several articles in Davis Enterprise spring 2005) and, together with the developer, had put forward a proposed agreement in which the developer put in a “package” of additional benefits for the community. One of the developers claimed: *“The*

draft agreement is the result of an unprecedented partnership between the citizens of Davis and Davis city government. Crafted after a decade of public input, design, planning, review and negotiation, the agreement guarantees that this innovative solar neighbourhood will bring benefits to all Davis and reflect our community's values." (Davis Enterprise, May 18th 2005) The project was presented as the 'New Urbanism' with emphasis on walk-ability, attractive design, open spaces and habitat areas and other features. The design for Covell Village has a very good internal system of cycle paths in open green spaces and also excellent contacts with the main bike network in Davis. Nine over- and underpasses were to be built to improve the safety and attractiveness of the bicycle mode. Free public transport was to be provided to the residents. The Covell Village proposal did include all demands from the City on catering for walking and cycling. This substantial "package" of benefits reflects the fact that the developer had to make the new development seem like a good "thing" to more than half the electorate in Davis to be able to go ahead with the project, which would have a sales value of over \$1bn when finished. But even this package was not enough, since the Covell Village development proposal was rejected in the referendum in the fall 2005, with a 60 to 40 vote (on November 8th 2005 19,015 of 36,658 registered voters (51.8%) took part in the referendum. 59.9% voted NO, while 40% voted yes to annexation of land for Covell Village).

Counterfactual discussion

What would have happened if Village Homes never was built, or if the Bike petition had lost at the election in 1966? It is of course impossible to give more than a speculative answer to such counterfactual questions, but they may shed light on the development that occurred. See Table 3.

This counterfactual discussion shows how dependent events are of earlier events and how the path towards the bike-friendly Davis of today has gradually been developed. The land use and transportation system has been increasingly improved. The bike network is extensive, with over- and undercrossings and the modal split in Davis has a unique cycling share. This progression has been vulnerable on many occasions and if one or more of the events had not happened, Davis would probably have developed quite differently.

Without doubt, any alternative progress would have been "car-led", resulting in less walking and cycling. It is also probable that the "car-led" path would have led to a more sprawling development that in the nearby Woodlands.

The Covell Village would not be "sustainable" as a "bedroom community", but could facilitate sustainable transport within Davis.

Table 1: Counterfactual discussion if the events hadn't happened?

Event	If the event had not happened?
The Bike City 1966	Davis would have been far more car dependent today
Village Homes 1975-82	Housing in Davis would be far more sprawling, with less green open space and certainly less cycling. An interesting question is if Peter Katz would have written the book "New Urbanism" without Village Homes?
The General Plan and the Bike Plan 1987	These plans embedded the Bike city and the Eco city further in the minds of Davis citizens and strengthened the identity of Davis as place. Such perceptions were later decisive in the Covell Village referendum.
Pass Through Agreement 1987	Instrumental in preventing edge developments, without it Davis would have got shopping malls at highway junctions.
Alternative Transportation Task Force – ATTF 1994-96	ATTF did strengthen the perception of Davis as future orientated sustainable city with concern for the environment, active in preserving resources through cycling and solar heating. The synergy between the city and UCD was further strengthened by ATTF. Without adoption of the task force's ideas, the buses would probably still run on ordinary fuels, and UCD would probably have been a little less successful on hydrogen research?
"Measure J" 2000.	The measure strengthened democracy (subsidiarity) by transferring power from politicians to the citizens. Without this measure Covell Village would have been developed. It has also consequences in the future for all new developments.
The General Plan and the Bike Plan 2001	These plans outline the vision and aims for land use and transportation in Davis as small-scale bike friendly city, not wanting to grow fast or sprawl. Without these plans the future course would be less distinct.
Covell Village 2005	It is a paradox that Covell Village project fits with the vision outlined in the two plans above, if the "residents" would work in Davis. If they all would be commuting, then Covell Village would contribute to the increasing car dependence in the region.

Conclusions on Davis land use and transport planning

Davis has:

- ✓ A comprehensive and safe bike network
- ✓ Many cyclists (31% of all work trips on bike)
- ✓ Cheap and efficient public transport running on alternative fuels
- ✓ Established mobility management (bike promotion, car sharing, parking policy)
- ✓ Avoided edge developments
- ✓ Set a new standard for community development (Village Homes)

- ✓ Developed subsidiarity within a Californian framework

In summary, Davis is unique in the way the city has managed to develop a multifaceted governance system where the ultimate power rests with the citizens. Davis is unique in the way the city has managed to retain a very high number of cyclists against the powerful "car society". Davis is also unique in the way an integrated land use and transport policy has been incrementally developed resulting in high awareness of the need for environmentally sustainable transport and concrete actions resulting in a good

public transport system using alternative fuels.

The questions posed and lessons from Davis

Land use and transport policy

Question one: How was the land use and transport connection in Davis? What effect had planning and policy on the choice of transport mode? Was the development caused by a deliberate policy and was it sustainable?

The development of the land use and the transport system is well connected in Davis. The City Council made a decision in principle in the 1960s to develop a bike network. This has been gradually expanded and cycling and walking is now embedded in the planning and policy structure. UCD has developed an integrated transport policy for the campus in cooperation with the city and based on the principle of the bike network mentioned above and further developed it to cover all modes (public transport, walking, mobility management including parking policy) plus testing and using alternative fuels on buses. The Davis policy has been put to the people in elections and referendums and has been deliberated, tested and contested over years. Davis has a far more environmentally sustainable transport system than most US cities and can be compared with European cities.

Barriers and facilitators

Question two: How could the observed land use and transport development be explained? What were the factors facilitating cycling and what were the factors inhibiting more sustainable transport development?

The institutional framework and how power is distributed across government levels make it possible for the Davis City Council to decide land use and transport policy without inference of the county or state. This is a major difference to Europe where the national governments directly and indirectly have a great influence on local authorities. Within this framework there are still vested interests that resist changes and the hegemony of the car culture is making policy shifts towards environmentally sustainable transportation very difficult. It is necessary to develop a framework right from federal level through to the state and local levels for environmentally sustainable transport to become effective. Without such a framework it will become very difficult for a city to promote sustainable transport on its own.

Cycling infrastructure combined with bike promotion, traffic management schemes and parking policy are factors that promote cycling. Both Davis City and UCD have for many years successfully done this, and the number of daily cyclists is far higher than most places.

Barriers to walking and cycling in Davis are identified through the lack of a safe infrastructure, particularly safe crossings Downtown. It is the perceived safety which is important for people's choices. The Davis City Council has not been able (wanted?) to implement pedestrian streets, parking restrictions or other measures, which are regarded as negative towards the car. Secondly, the alternative modes available and the time, cost and ease of using these, govern mode choice. The car is a superior mode for most people for most journeys, even in Davis. To break the embedded nature

of the car culture at the city level seems very difficult without a strong framework.

Learning from Davis? What, if any, are the lessons from Davis for medium sized cities in Europe?

Subsidiarity in practice

(Subsidiarity is the principle which states that matters ought to be handled by the smallest or the lowest competent authority).

The first lesson from Davis is how local democracy has been developed. The decisions both for land use and local transport are taken at the city level without interference from higher levels. The American and European traditions have evolved with substantially different results.

Subsidiarity is, ideally or in principle, one of the features of federalism. In a European context subsidiarity is the idea that a central authority should have a subsidiary function, performing only those tasks, which cannot be performed effectively at a more immediate or local level (The Oxford English Dictionary). For land use and transport planning the competence for planning and decisions should be decentralised or delegated from central government to regional or local authorities, but still central government keep control. In California and Davis one may say that the principle of subsidiarity is well established, given that the city decides both land use and transport policy and is wholly responsible for financing and implementing policy. The City of Davis has taken this even further and introduced a referendum (in particular cases) as the final decision-making process. Thus the decisions of the elected representatives in the council can be checked/controlled by the voters.

This makes the Council's decision-making more transparent and enhances democracy. The transparency that this referendum demands gave Davis a sizeable development gain through the Covell Village negotiation.

Integrated land use and transport planning – a necessity

The success of Davis in creating a “relatively” environmentally sustainable city has two main causes: firstly, the self-government of Davis and secondly the physically close yet separate jurisdiction of UCD. Both of these have the final say in land use and local transportation issues and may implement their own strategies. Both of these jurisdictions have had the power to implement their programme and policies, unlike cities in Europe. The problem of implementation in Government hierarchies is well known. Plans and decisions may be developed and decided by one state organisation and financed by another, while implementation often demands active players locally (Friedman 1987). The second lesson from Davis is that the organisation responsible for planning and policy also should be responsible for funding and implementation.

An Environmentally Sustainable Transportation Framework

The third lesson from Davis is that a city cannot in the long run develop a sustainable transport policy without adapting the policy to the larger region it is part of. If the state of California and the Sacramento region had an active sustainable transport policy, Davis would have had more understanding and leeway to develop restrictions on car use. Without such a framework, the city policies will be limited to “promotion and

marketing" of sustainable transport policies. A hierarchical framework across levels is necessary for a city to develop in a sustainable way and to avoid what Hull cited above called "the regulatory abyss and the institutional fragmentation of policy makers and public transport providers". There is also a necessary condition that the instruments and tools available at local level must not be contradicted or opposed by more general instruments decided by the state or at federal level.

Davis has developed measures that work with the market (Pass through agreement, Urban extension ballot). This is less common in Europe. There is also an important side effect of these measures, that they are openly discussed and transparent. This limits "confidential negotiations" and "closed politics" to a minimum and gives fewer opportunities for corruption.

References

Alexander E R and Faludi Andreas 1988 *Planning and plan implementation: notes on evaluation criteria* Environment and Planning B: Planning and Design, 16, pp. 127-140

Albrechts Louis *New Strategic Spatial Planning in Europe and Australia* Paper for the AESOP Congress in Grenoble-France July 1-4 2004

Beatley Timothy and Adri van der Brink *Technocratic v. Sociocratic Spatial Planning: A US-Dutch Comparison*. Paper for the ACSP-AESOP Third Joint Congress. Leuven (Belgium) July 8-12, 2003

Delucchi Mark, Ken Kurani, Kevin Nesbitt and Tom Turrentine. (2002) *How can we*

have safe, convenient, clean, affordable, pleasant transportation without making people drive less or give up suburban living? UC Davis

Commission for Integrated Transport. 2001 *European best practice in delivering integrated transport* London UK

Corbett, Michael and Judy Corbett. 2000. *Designing Sustainable Communities: Learning from Village Homes*. Washington DC: Island Press.

Department of the Environment, Transport and the Regions (DETR), 2001. *PPG13. Transport*. London The Stationary Office (<http://www.dtlr.gov.uk>)

European Environment Agency, 2006. *Transport and environment: facing a dilemma* Term 2005: indicators tracking transport and environment in the European Union European Environment Agency, EEA Report No 3/2006.

Fitch Mike, 1998. *Growing Pains: Thirty Years in the History of Davis*. Copyright © 1998 by the City of Davis.

Flyvbjerg, Bent 1998 *Rationality and Power: Democracy in Practise*. Chicago University Press

Francis, Mark. 2003. *Village Homes: A Community by Design*. Washington DC: Island Press.

Friedman John, 1987. *Planning in the Public Domain*. Princeton University Press

Hall, Peter and Ulrich Pfeiffer, 2000. *URBAN FUTURES 21* Spon Press

Hull, Angela (2003) *Integrated Transport Planning: A case study of regional*

planning in the UK. Paper presented at the AESOP_ACSO 3rd Joint Congress, Leuven

Knaap Gerrit-Jan and Yan Song. *The Transportation-Land Use Policy Connection*

Conference *Access to Destination: Rethinking the Transportation Future of our Region* November 2004 Minnesota University

Lofland John, 2004. *Radical changes Deep constants*. Arcadia publishing San Francisco

Nyström, Louise (2002) *Urban Quality of Life in Europe*, Nordisk Arkitekturforskning, 2002:4

Næss Petter, 2006. *Urban structure matters*. Routledge London

OECD/ECMT 1995 *Urban travel and sustainable development* Paris

Pucher John and Christian Lefèvre, 1996 *The Urban Transportation Crisis in Europe and North America* Macmillan

Pucher John, Charles Komanoff, Paul Schimek *Bicycle renaissance in North America? Recent trends and alternative policies to promote bicycling*. Transportation Research Part A, Vol. 33, Nos. 7/8 1999, pp 625-654.

Renne, J L & J S, Wells, 2004 *Emerging European-style planning in the USA: Transit oriented development* Transport Policy Vol. 7

Sheller, M, and Urry, J (2000) *The City and the Car*. International Journal of Urban and Regional Research 4 (24): 737-757.

Stead, D (2003) *Transport and land-use planning policy: really joined up?* UNESCO

Syklistenes landsforening, *Sofus prisen 1983*

Tengström Emin 1999 *Towards Environmental Sustainability? A comparative study of Danish, Dutch and Swedish transport policies in a European context* Ashgate

Toor Will, and Spencer W. Havlick. 2004. *Transportation and Sustainable Campus Communities*. Island Press

UN-Habitat, (2004) *The State of the Worlds Cities 2004/2005. Globalization and urban culture*, Earthscan

Vigar, Geoff, Healey, Patsy, Hull, Angela, and Davoudi, Simon (2000) *Planning, Governance and Spatial Strategy-Making in Britain: An Institutional Analysis*. MacMillan, London

Address for Correspondence:

Anders Langeland

University of Stavanger
Agder Research

Email: anders.langeland@uis.no

Unlocking the potential of Site Based Mobility Management through Local Travel Plan Groups



Dr Marcus Enoch, Mr Lian Zhang and
Dr Stephen Ison

1. INTRODUCTION

In the UK Government guidance 'A Travel Plan Resource Pack for Employers' (EEBPP, 2001a) a travel plan is defined as: 'a general term for a package of measures tailored to meet the needs of individual sites and aimed at promoting greener, cleaner travel choices and reducing reliance on the car. It involves the development of a set of mechanisms, initiatives and targets that together can enable an organisation to reduce the impact of travel and transport on the environment, whilst also bringing a number of other benefits to the organisation as an employer and to staff.'

Travel plans have been known in Europe as 'site-based mobility management', 'green transport plans', 'green travel plans', 'green commuting', 'company mobility plans', and 'employer transport plans', while in the USA they are encompassed by the term TDM (Transportation Demand Management).

The idea behind travel plans started in the USA – particularly on the West Coast - as a quick and easy response to the fuel crises during the 1970s, but they were fairly slow to permeate across the Atlantic. Indeed, in the UK the first travel plans only began to appear during the early 1990s, with the first official policy record being made in the 1998 Transport White Paper – A new deal for transport: Better for everyone (DETR, 1998). In brief, the attractions of travel plans to

Governments and local authorities are that they are reasonably quick to introduce, relatively cheap and perhaps most importantly are usually politically acceptable. In short, they are an 'easy win'. This is in marked contrast to other transport measures which often require high levels of investment over a long period of time and can carry a high political risk. Crucially however, travel plans are dependent on other organisations, namely traffic generators such as employers, retail parks and hospitals being motivated to participate in helping to solve something that 'is not their problem'. Thus, organisations will generally only consider travel plans if they:

- need to solve a transport problem, such as access for employees, shortage of parking, traffic congestion, air pollution (for airports in particular) on site or off-site.
- need to address a space problem. Here an organisation may be expanding and in order to develop needs to build on land currently given over to parking spaces.
- need planning permission. If they are seeking to expand an organisation will require planning permission which may stipulate the need to introduce a travel plan.
- want to save money, since parking provision is expensive and reducing levels of parking provision can reduce company costs.

- want to enhance their image either in the local community or at a board level. The argument could be that we are an environmentally conscious organisation and so deserve to be invested in by your ethical account holders.
- are told to do so. In the UK, the National Health Service now requires its sites to develop plans, as do Government Departments. Schools are now also being pushed to adopt travel plans for a number of reasons: reducing congestion, air pollution and road traffic accidents and also for health reasons.

As a result, studies have shown at the site level that UK plans combining both incentives to using alternatives to the car, together with disincentives to drive, can achieve a 15-30 percent reduction in drive alone commuting (DTLR, 2001), while Knaap and Ing (1996) reported a 20 percent average reduction at sites in the Netherlands and the USA. Meanwhile Schreffler (1998) noted that some exceptional case studies in the USA reported trip reduction rates of 50% and more. But, at the network level the figures are almost negligible. For instance, Rye (2002) estimates that travel plans have removed just over 150,000 car trips from British roads each working day, or 1.14 billion km per year, i.e. around three quarters of one percent of the total vehicle km travelled to work by car overall. Rye (2002) identifies several key barriers to wider travel plan implementation, namely:

Companies' self interest and internal organisational barriers;

Lack of regulatory requirements for travel plans;

Personal taxation and commuting issues;

The poor quality of alternatives (particularly public transport);

Lack of examples due to novelty of the concept.

One possible way to overcoming some of these barriers, is to establish some kind of 'Local Travel Plan Group' (LTPG) and this forms the focus of this paper.

The paper is structured as follows: Section 2 defines and details the potential benefits of LTPG's, while Section 3 describes how LTPGs may fit within a wider transport planning organisational structure and Section 4 seeks to classify a range of types of LTPG. Section 5 examines how LTPGs have performed in practice and Section 6 investigates the role of the 'strategic level' of transport planning organisation. Section 7 details implementation issues and Section 8 presents conclusions.

2. LOCAL TRAVEL PLAN GROUPS AND THEIR POTENTIAL BENEFITS

Any group of organisations that comes together to share resources and ideas for developing and implementing a travel plan in their local area could be identified as being a Local Travel Plan Group (LTPG). There are a number of benefits of forming some type of LTPG. For instance, such a grouping is collectively able to achieve more than single agencies or employers when dealing with common concerns. This is based on pooled resources, delivering higher investment, dedicated staff, and greater political influence, yet it allows the member companies/organisations to focus more on their core competencies.

Secondly, LTPGs have the ability to move Transport Demand Measures (TDM) from a site-specific application to a more flexible and effective area-wide application.

The nature of transportation and environmental issues is that each employer or agency has the potential to impact upon others and to allow each member to become part of the solution (Anderson and Ungemah, 2002). Finally, LTPGs can improve the level of communication between the sectors and allow the level of flexibility necessary to ensure that transport objectives are met in ways that maximise the benefits for businesses, residents and commuters.

Such an approach is supported in the seminal Department for Transport's Smarter Choices Report (Cairns et al., 2004), which noted that one of the key issues necessary for 'scaling up' the use and impact of travel plans was for an area wide approach to be adopted. Specifically it stated that "travel planning might become more commonplace in smaller organisations if it was part of a neighbourhood or area wide approach."

EEBPP (2001b) found that travel plan networks were 'especially effective in furthering travel plans' and suggested they have four main roles, namely to:

- Exchange information, ideas and good practice;
- Provide moral and practical support for those involved in travel plan development;
- Make viable the provision of services relating to travel plans on a collective basis; and
- Combine efforts to generate an effective bargaining force.

It continues that "the benefits of networks are that concerted action by a number of organisations makes things more likely to happen. Travel plans are more likely to be prepared and implemented by organisations with the impetus of a network behind them... largely from the greater influence of a larger organisation and economies of scale". Finally, the EEBPP report notes the benefits to local authorities of establishing a network. These, it states, are:

- the advantage of a single contact point for a variety of organisations;
- novel ideas that might not have been considered can emerge from a network, and be applied to other networks with which the authority might be involved;
- contact with a network allows an authority to gauge attitudes towards its own initiatives and can offer early warning of problems;
- news of successes, and the fact that collective effort is seen to be applied to transport and access problems, can benefit the local economy by attracting new businesses to an area and retaining existing businesses.

Clearly, the LTPG may be worth considering as a new way of delivering travel plans.

3. LTPGs WITHIN THE WIDER TRANSPORT PLANNING ORGANISATIONAL STRUCTURE

Traditionally, transport and planning functions have been undertaken at a variety of administrative levels, whereby European and National Government decisions influence the overall direction of policy, and the actual application of those policies is carried out at the regional and/or local government level.

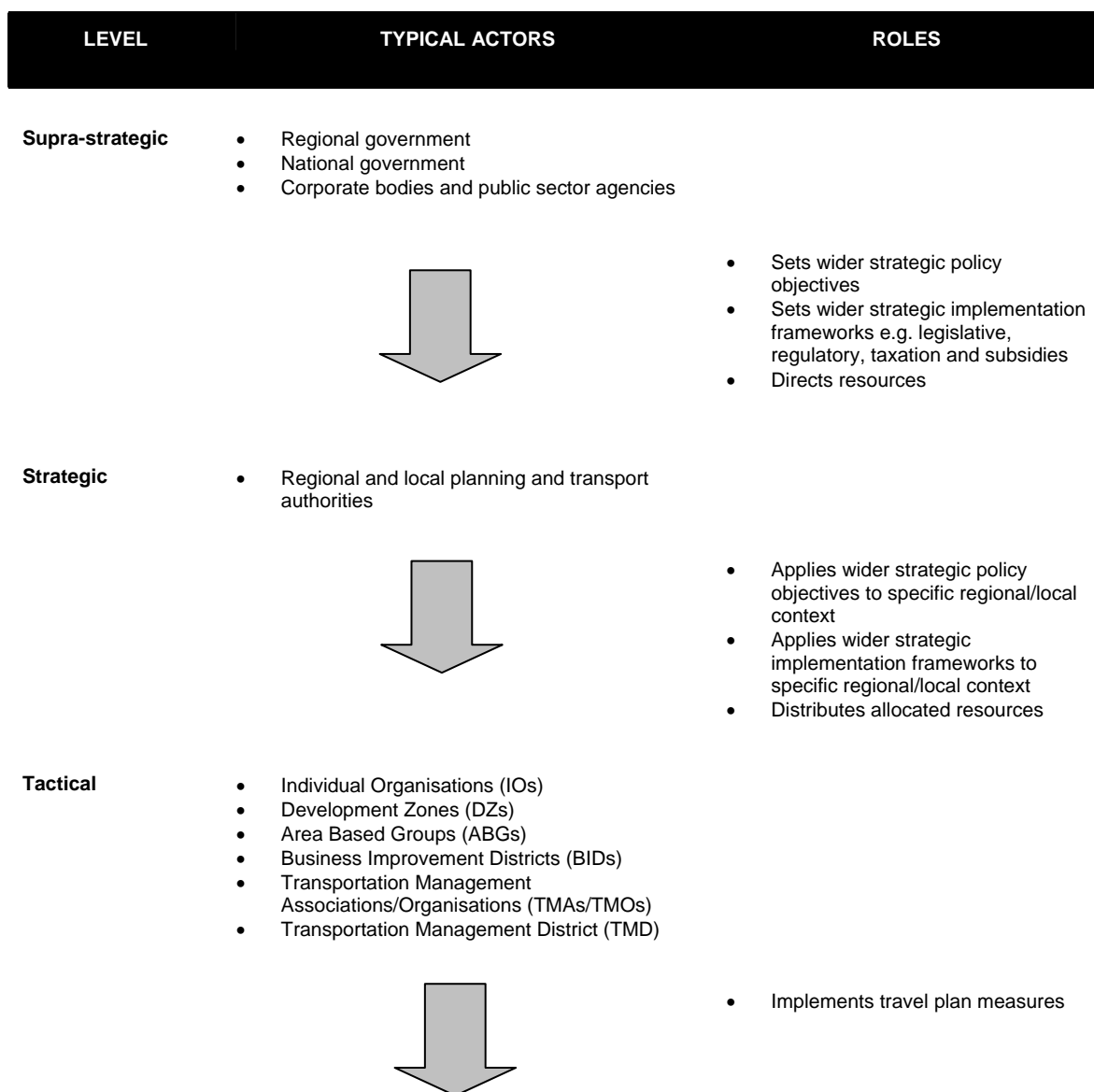
In recent years however there has been a shift in emphasis towards 'partnerships' being formed with community groups and the private sector (Newman and Thornley, 1996). In this sense the adoption of the concept of LTPG's forms part of this trend, whereby another 'delivery' level of transport tools effectively comes into being – these can be termed tactical and strategic.

The tactical level is the basic implementation of travel plans measured on the 'ground' – that is the 'new' LTPG'. The strategic level effectively comprises

the local and regional planning and transport authorities. These bodies are responsible for applying wider strategic policy objectives and strategic implementation frameworks in a specific local/regional context and distributing the allocated resources. There may also be a supra-strategic level consisting primarily of European and National government. This level however falls largely outside the remit of this paper.

These relationships are illustrated in Figure 1.

Figure 1: Tactical, strategic and supra-strategic actors and roles



4. DEVELOPING A TAXONOMY OF LTPG TYPES

In terms of the research undertaken as part of the OPTIMUM2 programme it was possible to identify the following six categories in terms of the tactical level of LTPG's namely: Individual Organisations, Development Zones, Area Based Groups, Business Improvement Districts, Transportation Management Associations, and Transportation Management Districts. These can be described as follows:

Individual Organisations (IO's) refer to local authorities, government departments, hospitals, school/universities and private organisations, who have one or more large-scale worksites at a range of different locations. Aimed at employees, visitors, customers and suppliers, IO's introduce travel plans for many reasons, including solving transport or space problems, saving money, enhancing their image, in order to get planning permission or because they are legally required to. Typically, IO's appoint a coordinator to establish, manage and monitor the travel plans by using their own resources with or without local authorities support.

Development Zones (DZ's) refer to local areas developed for a specific use, such as business parks, retail parks, industrial estates, leisure parks and even airports. The overall area is usually owned (or at least managed) by a single private or public sector body that 'hosts' a number of 'tenant' organisations that are located there. The motivation for DZ's being involved in the development of a travel plan are largely similar to those facing the larger IO's. With or without local authorities support, the site owner or manager (sometimes a tenant) provides travel plan coordinator(s) who establish, manage and

monitor travel plans by using contributions, levy or rental fees from the tenants.

Area Based Groups (ABG's) are informal networks of organisations that operate, or are interested in operating, travel plans located within a loosely defined neighbourhood. They exist where two or more organisations feel combining resources will be a more effective way to deal with transport issues, and are generally formed either by local authorities 'suggesting' groups or by one leading organisation taking the lead in helping to address a specific transport issue.

Business Improvement Districts (BID's) are a partnership management initiative between a local authority and the business community which provides investment within a defined area. A BID is designed to assist business in funding and developing projects in order to address specific problems and issues with solutions the businesses believe are right (UKBID's, 2005). To date, the focus in the UK schemes has mainly been on physical improvements to the urban realm and community safety, although accessibility and transport objectives are sometimes included.

Transportation Management Associations (TMA's), (also known as Transportation Management Organisations) is an "organised group applying carefully selected approaches to facilitating the movement of people and goods within an area" (NCTR, 2001). TMA's are often led by the private sector in partnership with the public sector aimed at solving transport problems.

Transportation Management Districts (TMD's) utilise Transportation Demand Management (TDM) strategies to encourage the use of alternatives to single-occupancy

vehicle commuting within a legally designated geographical area. The crucial difference between a TMD and the other forms of LTPG already identified is that organisations with more than a set minimum number of employees within the District are legally required by local ordinances to participate – usually by being obliged to produce, implement and monitor some form of travel plan. The various LTPG's can be illustrated in Table 1.

Table 1 illustrates the range of LTPG's. With IO's all the decisions are taken 'in house'; whereas on an area/neighbourhood basis, most notably in terms of DZ, BID, TMA, and TMD transport matters are delegated to a single management company. As for ABG's they are far more loosely and informally structured. Also evident is the split between organisational structures where transport is the major reason for the group's existence and where it is but one of several.

Member participation would seem to vary from quite didactic relationships between landlords and tenants with for example DZ's and TMD's to more equitable arrangements for the others, while motivations for establishing the groups tends to be driven either by organisational self interest or by legal requirement. Interestingly, the primary and secondary actors switch between the public and private sector, with the private sector leading where self interest is the motivating factor and the public sector taking charge when mandatory schemes are paramount. Developing this further by examining the role of the local authority, when travel plan schemes and networks are voluntarily established by the business community, the role of the local authority is supportive. Where travel plans are not a business priority the role is far more intensive and

regulatory, for example, where the planning system (via planning obligations or conditions) is used to require developers to establish a travel plan in return for obtaining planning permission.

Finally, funding types tend to be ad hoc arrangements, often public or private sector grants or investments, for IO/DZ/ABG's, but rather more formalised for the BID's and TMA's.

5. LTPG's IN PRACTICE

This section provides examples of each type of LTPG and provides some indication of their effectiveness.

Individual Organisations

The US-based pharmaceutical company Pfizer has its main UK manufacturing and research facility in Sandwich, Kent and a European corporate headquarters in Walton Oaks in Surrey. Pfizer employees were frustrated by the traffic congestion especially at its Kent plant. Many staff had difficulty finding parking spaces and often had to walk a long distance from their parking space to the office (Pfizer, 2005). In addressing these problems, Pfizer introduced a travel plan at its working sites both for employees and visitors. A 'parking cash out' incentive scheme and shuttle bus service have also been provided. According to Pfizer's first travel survey, the number of cars coming onto its Sandwich site for every 100 staff fell from 75 in 1998 to 68 in 2001 where it has since stabilised. As a result, the company reduced its parking spaces by approximately 400. Other examples of IO's include Derriford Hospital in Plymouth and Vodafone in Berkshire.

Table 1: Local Travel Plan Group structures

	Individual Organisations (IOs)	Development Zones (DZs)	Area Based Groups (ABGs)	Business Improvement Districts (BIDs)	Transportation Management Associations (TMAs)	Transportation Management Districts (TMDs)
Geographic	IOs located anywhere. Clearly demarcated	Often 'edge or out-of-town' areas with non-car poor access. Clearly demarcated	Potentially anywhere but often within areas of large cities. Not clearly demarcated	Tend to be focused on city centres or large DZs. Clearly demarcated (legally)	Often 'edge or out-of-town' areas with non-car poor access. Often clearly demarcated	Located in suburban centres of major conurbation. Clearly demarcated
Organisational environment	Mostly large organisations in public and private sector	Often large numbers of private sector retail or industrial units	Whole range of sizes, public and private sector; most sectors	Typically large number of private sector commercial and retail companies of various sizes	Often large numbers of private sector retail or industrial units of all sizes	Whole range of sizes, public and private sector; most sectors
Political	Can be internally or Local Authority driven	Can be internally or Local Authority driven	Usually internally driven with Local Authority support	Can be internally or LA driven but needs both to work effectively	Can be internally or Local Authority driven but needs both to work effectively	Local Authority driven
Legal	None	None	None	Requires legal framework	None	Requires legal framework
Institutional	Organisation pre-existing	Organisation pre-existing	New organisation	Organisation pre-existing	New organisation	New organisation
Scale of the 'problem'	Site based	Site based	Neighbourhood	Neighbourhood	Site based	Neighbourhood
Scope of the 'problem'	Several issues	Several issues	Transport only	Several issues	Transport only	Transport only

Development Zones

Stockley Park occupies a large site near Heathrow Airport to the west of London and accommodates 7 700 full time equivalent staff. Overall, the site is operated as a single entity, and the travel plan is included within this management remit. The Park has had a travel plan since 1998 which covers various initiatives e.g. car sharing, cycling and walking, public transport and awareness-raising. A survey conducted in 2002 shows that since 1999, there was a 1% increase in the use of underground rail, a 1.2% increase in rail commuting and a 3.4% increase in bus use. There is also a target of reducing car use for commuting by 20% by 2009 (SPCL, 2004). Other DZ examples include BAA Heathrow Airport in west London and Regent's Place in central London.

Area Based Groups

Bristol City Council set up a Green Commuter Club in 1999 following a conference designed to promote travel plans among companies in the city. This now has more than 85 members and meets on a quarterly basis. In 2001, a number of the members were about to move into a new development area known as Temple Quay and so decided, together with the City Council, to set up their own sub-group. The Temple Quay Employer Group now has 15 members both in and next to the newly developed area. Members of the sub group are required to sign up to a statement of intent which commits the company to addressing common issues. Projects such as a car sharing database – are financed by contributions from the Council and member companies on a project by project basis. Initially, the TOEG was run by the council, but recently some of the organisational effort has been taken on by Norwich Union (Ginger, 2005). Other ABG examples

include Northside, Southside and Lenton Lane Employer Groups in Nottingham.

Business Improvement Districts

Downtown BID of the City of Boulder in Colorado is a 49-block neighbourhood which suffers a shortage of parking. To keep the downtown area healthy and attractive, the city decided to build no more parking and instead focus on promoting alternative commuting. A goal is to get employees of business in the BID out of their cars at least two days a week by providing subsidised transit passes, free bicycle rentals and other initiatives with full support from the local businesses. When the programme started in 1994, 35% of the district's 10000 employees participated. Participation in 2002 was up to 42% (BWC, 2002; Ward, 2005). Other BID examples include the Perimeter Community Improvement Districts in Atlanta, Georgia and Kingston First in Kingston upon Thames.

Transportation Management Associations

The Amsterdam Schiphol Airport TMA is a partnership between the Dutch central government, airport operator, airport-based companies and public transport operators. TMA Schiphol was established to achieve a high level of accessibility and assist employees in finding optimal solutions to and from Schiphol airport. Companies interested in joining the TMA need to register as a member by paying a membership fee and in return, they receive TMA services such as consultancy on airport accessibility, public transport information and car sharing. Between 1997 and 2001 the number of TMA member companies increased from 45 to 67. In 2001 these companies employed 42 300 employees, or 80% of the total workforce of Schiphol-based companies. Total car use, including

car sharing, reduced from 72% in 1996 to 69.6% in 2000/1 and total public transport use increased from 19.4% to 21.1% over the same period. Schiphol airport regarded this as a success, as car use in society as a whole has risen during this period (Tapestry, 2003; Reeve et al., 2003 and Sam, 2001). Other examples of TMA's include Dyce TMO in Aberdeen, Black Creek Region TMA in Greater Toronto and Lloyd District TMA in Portland, Oregon.

Transportation Management Districts

The only TMDs in operation currently exist in Montgomery County, Maryland. Approximately 120 000 commuters and 1,120 employers are arranged in four TMDs, that range in size from 5 000 to 65000 employees (50 to 520 employers). TMDs legally require employers of more than a set minimum of employees to produce, implement and monitor a travel plan. The purpose of the TMDs, was to promote the County's land use and economic development objectives of increasing development densities around transit stations and making station areas attractive and convenient places in which to live, work, shop and do business (MCC, 2004).

From the research undertaken – which was based on existing material supported by email, telephone or face to face interviews – it is difficult to judge the effectiveness of the groups in delivering their transport objectives, since in many cases the data does not exist and even when it does it is not robust enough to draw more than cursory conclusions. For this to be remedied, a series of in-depth case studies would need to be undertaken to examine group or perhaps network issues, such as the type of member participation, degree of internal communication, level of awareness

of group existence, contextual issues and the results of the group in terms of transport goals achieved. Despite this, it is still worth considering the various contextual factors that are exhibited for each LTPG type, and these are summarised in Table 2.

In terms of the geographic factors the DZ's and TMA's tend to have distinctive borders and are typically located at edge or out-of-town sites, whereas ABDs, BID's and the TMD examples are usually found in inner city or downtown areas and can have quite blurred boundaries.

The organisational environment refers to the number of organisations, locations (edge of town, city centre), distribution (clusters, evenly spread, corridors), sectors (industrial, leisure, retail, commercial, health, education etc), and size (number of employees and visitors).

Politically, the split is actually less to do with type of LTPG than with the motivation behind its formation – i.e. is it implemented because of self interest or as a legal requirement. The exceptions are that TMD's are always pushed by legal requirement while the ABG's are usually voluntary. Of the remainder, IO's and DZ's tend to be either voluntary or mandatory, while the BID's and TMA's seem far more dependent on both public and private bodies 'buying in' to the groups and taking the lead at different stages of their development.

Table 2: Contextual factors of the various Local Travel Plan Group structures

	Individual Organisations (IOs)	Development Zones (DZs)	Area Based Groups (ABGs)	Business Improvement Districts (BIDs)	Transportation Management Associations (TMAs)	Transportation Management Districts (TMDs)
Definition	Organisations that operate their own travel plans	Local areas developed for specific uses	Informal networks in a loosely defined neighbourhood	LA-business partnership to invest within a defined area	Private, non-profit, member-controlled organisations for defined area	Companies in defined area legally required to develop travel plans
Group structure	Single organisation	Leading organisation and members	Organisations all equal	Coordinating organisation created	Coordinating organisation created	Led by Local Authority coordinating organisation
Degree of formality	n/a	Landlord-tenant – formal	Common interest – informal	Financial (tax) – very formal	Financial (member fee) – fairly formal	Legal requirement – very formal
Transport only issue?	No	No	Yes	No	Yes	Yes
Member participation	In single organisation	Landlord in control	Power shared equally	Full membership in control	Full membership in control	Local Authority in control
Motivation of group formation	Legal requirement or self interest (e.g. corporate image, site congestion).	Legal requirement or self interest	Self interest. Members see benefits of sharing resources.	Self interest for majority who vote to form BID. Minority req'd to join.	Legal requirement or self interest. Members seek to jointly improve area	Organisations in designated areas legally required to adopt travel plans
Primary actor	IO/ Local Authority	DZ/ Local Authority	LA/private companies	Local Authority initially, then private BID company	Local Authority /private companies	Local Authority
Secondary actors	Local Authority/IO	Local Authority /DZ	Private companies/ Local Authority	Member organisations	Member organisations	Member organisations
Role of Local Authority (vol. TP)	Support and implementer	Support	Support and facilitator	Initiator and facilitator	Support and initiator	Regulator
Role of Local Authority (req'd TP)	Regulator	Regulator	Support	n/a	Regulator	Regulator
Funding	IO/ Local Authority – ad hoc	Ad hoc grants, rent	Ad hoc grants, scheme basis	Business levy	Ad hoc, sometimes fees	Local authority funded

The institutional issue is focused on whether a suitable existing group may be used to 'piggyback' transport issues. This can be easier than setting up a brand new specialist group but can also be less focused on delivering transport goals, especially if transport objectives are not fully accepted by other members. IO's, DZ's and BID's form the pre-existing LTPG types, while ABD's, TMA's and TMD's are set up specifically to deal with transport issues. Related to this is the scope of the problem. Thus, is transport the only, or at least most significant, local issue, or should a group deal with wider issues too?

The scale of the problem refers to whether the issue to be dealt with requires a localised or site-based solution, or whether it needs to be addressed on a neighbourhood basis. IO's, DZ's and TMA's tend to focus on site specific concerns, whereas the others are more amorphous and deal with issues across neighbourhoods.

The final contextual factor relates to the travel plan specific policy context of the local area or the scope of the problem.

In summary, it is probably the contextual factors that most strongly influence the choice of LTPG type in the first instance. This is because the motivations for group formation and primary actors depend on the perceived scope and scale of the problem, while this combined with the geographic, organisational environments, political, and institutional factors encountered will significantly restrict the choice of group type.

6. THE STRATEGIC LEVEL

The typical actors, in the UK at least at the strategic level would tend to be regional and local planning and transport

authorities, most notably Passenger Transport Executives, Transport for London, London Boroughs, County Councils, District Councils and Unitary Authorities. The roles of such actors would be that it:

- applies wider strategic policy objectives to the specific regional/local context;
- applies wider strategic implementation frameworks to the specific regional/local context; and
- distributes allocated resources.

It is the link between the strategic and tactical levels however that is of particular interest. The research undertaken as part of this study reveals that interfacing arrangements between the public and private sectors (strategic and tactical levels) began appearing in the late 1980s, and in general are based on some kind of agreement between a particular local authority and one or more private sector interest groups with the aim of promoting specific partnership projects within their area of operation. Some have also involved or co-opted representatives from the local community and the voluntary sectors. Overall management is provided by a board or committee made up of local authority councillors and participant company directors, with day to day activity undertaken by employed officials, some on a permanent basis, but most seconded from the agency's partners for varying periods of time (Gore, 1991).

But, as Verma (2005) points out, partly because of shrinking funding levels and partly because of growth within the sector, both the not-for-profit and public organisations have been experiencing increased competition for scarce resources. To achieve the best results, a joint enabling agency needs to have a clear sense of

mission, a well led, professionally managed and fiscally sound organisation (Gelatt, 1992). Therefore, as with for-profit companies, not-for-profit partnerships tend to establish clear objectives in terms of their implementation. But unlike for-profit organisations, they often do not establish readily quantifiable targets and this can make monitoring their performance somewhat difficult (Oster, 1995).

7. IMPLEMENTATION ISSUES

As the lead partner at the strategic level Local Authorities role is to develop a structure for the LTPG network in its area; to define the goals of this overall project and the objectives of the different partners; and to identify the roles of different partners involved (Samii, 2002). In that local authorities are all important in implementing, operating and supporting LTPGs, it can be stated that their role falls somewhere between a federalised and centralised frame.

The various attributes of each organisation within these two frames of reference are illustrated in Table 3.

The federalised frame tends to exist in situations where there are a fairly small number of large, powerful, influential and cohesive local groups/organisations already in place, which in the UK at least form the vast majority of cases. However, perhaps the most notable exception to this is occurring in Birmingham, England where the local authority has taken on a far more pro-active role and instead encourages companies to join its centrally run travel plan to use its centrally administered travel plan services as and when required (Cairns et al., 2004). The philosophy here is that greater overall behavioural change can be generated by many companies making

relatively small contributions than by far fewer companies making larger individual impacts - affiliates are charged with achieving a reduction of 10% in car commuting journeys. As of September 2006, 242 organisations had signed up to Company TravelWise covering over 152000 employees, or just over 30% of the city's workforce making it the largest such group in the UK (Cooper, 2006). By contrast, the expectation for organisations in other areas can sometimes be that car use should be reduced by anything up to 30%. There is also the issue relating to the level of involvement of the planning or transport authority at the strategic level vis a vis the tactical organisations. This ranges from a highly interventionist to a more laissez faire approach.

One example of the former is York City Council, whereby the council effectively chooses to work intensively with a relatively small group of organisations. Meanwhile Levantis (2005) has built on this approach in developing a so-called Zonal Travel Plan (a new form of ABG) in the London Borough of Islington, and DZ's and ABG's near Northampton, Southampton, Leicester and Newcastle. It does this by identifying organisations that already have travel plans and using them to anchor 'clusters' of other organisations with less well developed plans. By contrast, in the Birmingham example outlined above, the council is far less 'hands on' and instead encourages organisations to use its central administered travel plan services as and when required (Cairns et al, 2004).

Following the choice of frame and LTPG type, the next step is to design and implement them. Kouwenhoven (1993) presents a framework or checklist designed to illustrate what is needed for the 'perfect

implementation' of public private partnerships (PPP). This is suitable because LTPGs are most commonly a partnership between the public and private sector charged with delivering a mutually beneficial project. In brief, Kouwenhoven

suggests that there are three types of 'condition' required, namely starting, interlinking and project.

Table 3: The role of the Local Authority in terms of the federalised and centralised frame

	Federalised	Centralised
Strategic body	As a facilitator Plays supporting role Sets up a network of tactical organisations May provide financial incentives Provides advice and encouragement Facilitates contacts Facilitates meetings	As a leader Plays leading role Establishes group for tactical organisations Provides financial assistance Provides advice and encouragement but may also use regulation as a stick Establishes contacts and negotiates deals Leads meetings
Tactical organisation	As a member Plays leading role Joins network Raises its own revenue Implements measures if in it's own interest Makes its own contacts Contributes to meetings	As a 'customer' Plays supporting role Joins group Draws on club resources Buys services from strategic body if in it's own interest or to meet regulatory targets Makes use of existing contacts and negotiated deals Attends meetings
General comments	Process is bottom up Relatively small number of active/enthusiastic members Large per member impacts	Process is top down Relatively large but mainly passive/reactive membership Relatively small per member impacts
Examples of interface models	Commuters Planning Club Nottingham, Bristol Green Employers Group; City of Boulder Transportation Demand Management; City of San Diego; Toronto Smart Commute Initiative; Montgomery County TMD;	TravelWise Birmingham, Rotterdam Vervoer Coördinatie Centrales

The starting conditions for a public private partnership are: Interdependence between the two sectors; and Convergence of objectives. Given the presence of these, the two secondary or 'interlinking' conditions are: The existence of a network of communication channels between the public and private sectors concerned; and

The existence of a broker to facilitate negotiations. Once these are in place, then the following project conditions need to be in place:

- ▽ Mutual trust;
- ▽ Unambiguous objectives and strategy;

- ∇ Unambiguous division of costs, risks and returns;
- ∇ Unambiguous division of responsibilities and authorities;
- ∇ Phasing of the project;
- ∇ Conflict regulation laid down beforehand;
- ∇ Legality;
- ∇ Protection of third parties' interests and rights;
- ∇ Adequate support and control facilities;
- ∇ Business and market-orientated thinking and acting;
- ∇ 'Internal' co-ordination; and
- ∇ Adequate project organisation.

The control phase is concerned with monitoring the performance of the LTPG. Traditionally, monitoring of travel plans has tended to focus on their performance in meeting only transport and financial outcomes. But, while these indicators obviously remain important, it is also important to monitor how the LTPG's and the interfaces are performing as organisations. Consequently, process factors such as the participation rates and levels of organisations within the LTPG's, and of the awareness of LTPG's and their roles at both organisational and individual levels are of key importance.

In summary, it should be noted that as with travel plans, every individual situation is different, and so care should be taken when transferring ideas from elsewhere to ensure that even subtle variations in context are accounted for. Therefore, while the general

framework described above should be applicable in a wide range of situations, it should always be remembered that it is only a framework.

8. CONCLUSIONS

This paper has aimed to investigate how Local Travel Plan Groups have been introduced in practice in order to facilitate the design of such schemes in the future.

In conclusion six types of LTPG were identified, namely: Individual Organisations, Development Zones, Area Based Groups, Business Improvement Districts, Transportation Management Associations, and Transportation Management Districts. These were devised according to the degree of formality and hierarchy within the groups, and whether transport was the core issue for the group or not. Other factors examined included motivations behind group formation and the roles of the various actors.

In terms of the performance of each LTPG type with respect to transport goals, a lack of sufficient detailed evidence precluded conclusions from being drawn regarding which type operates best under what circumstances. In-depth case studies using perhaps a group formation or network analysis theoretical framework would be most useful in order to properly investigate this. Current indications though, are that performance seems to be more influenced by the individual circumstances of each group than the type of LTPG per se.

It also appears likely that it is the contextual factors that most strongly influence the choice of LTPG type in the first instance. This is because the motivations for group formation and primary actors depend on the perceived scope and scale of the problem, while this combined with the geographic, organisational environments, political, and institutional will significantly restrict the choice of group type

that can be made. Beyond that, the choices are based on whether to adapt a suitable existing group to include transport within its remit or to set up a transport organisation. A decision needs to be taken as to how formal the group should be, on how it should be funded and ultimately on the exact roles of the stakeholders.

Moving to the role of local authorities interested in supporting LTPG's, two possible frames, namely the centralised and the federalised – have been identified. Under the former, the 'strategic agent' takes far more of a lead and seeks to maximise the number of participants, while in the federalised approach the net is not cast as broadly but participants tend to be more involved. Once again, the choice of which to adopt is heavily influenced by contextual factors, in this case partly the policy context and partly the resources available.

References

- Anderson, S.M. and Ungemah, D.H. (2002) Partnering Businesses, Developers, and Residents for Better Mobility, Transportation Management Organisations Detailed Memorandum, Report to the Jobs and Population Task Force, City of Boulder, Boulder, Colorado, 30 October.
- Best Workplaces for Commuters (2002) Marketing Your Commuter Benefits, Phone Forums, 22 May, BEST Workplaces for Commuters, U.S. Environmental Protection Agency, Washington D.C. Visit www.bwc.gov. Last accessed 17 August 2006.
- Cairns, S.; Sloman, L.; Newson, C.; Anable, J.; Kirkbride, A. and Goodwin, P. (2004) Smarter Choices – Changing the way we travel, Department for Transport, London. July.
- Cooper, M. (2006) Personal communication, Travel planner, Birmingham Company TravelWise, Birmingham, 18 September.
- Department for Transport, Local Government and the Regions (2001) Evaluation of Government Departments' Travel Plans, Report for the DTLR, London, April. Visit www.dft.gov.uk. Last accessed 31 May 2004.
- Department of the Environment, Transport and the Regions (1998) A new deal for transport: Better for everyone, DETR, The Stationery Office, London, July.
- Energy Efficiency Best Practice Programme (2001a) A Travel Plan Resource Pack for Employers, Energy Efficiency Best Practice Programme, Crown Copyright, The Stationery Office, London, June.
- Energy Efficiency Best Practice Programme (2001b) A guide on how to set up and run Travel Plan Networks, Good practice guide 314, Energy Efficiency Best Practice Programme, Crown Copyright, The Stationery Office, London, September.
- Gelatt, J.P. (1992) Managing Nonprofit Organisations in the 21st Century, Oryx Press, Phoenix, Arizona.
- Ginger, M. (2005) Telephone Interview, Bristol City Council, Bristol, 4 March.
- Gore, T. (1991) Public/Private Partnership Schemes in UK Urban Regeneration, The Role of Joint Enabling Agencies, Cities. 209-216, August.
- Knaap, R.J.J. van der and Ing, A.G. (1996) Effective TDM at worksites in the Netherlands and the US, Organisational Coaching in association with Eric N Shreffler.

Kouwenhoven, V. (1993) Public-private partnership: a model for the management of public-private co-operation, in (ed. Kooiman J) *Modern Governance: New Government-Society interactions*, Sage, London.

Levantis, S. (2005) Personal communication, Transport planner, JMP Consulting, London, 18 May.

Montgomery County Council (2004) *Friendship Heights Transportation Management District Montgomery County Maryland Activities and Performance Fiscal Years 2000-2002*, Montgomery County Commuter Services, Silver Spring, Maryland, August.

National Center for Transit Research (2001) *TMA Handbook: A guide to successful Transportation Management Associations*, Center for Urban Transportation Research, University of South Florida, Tampa, FL.

Newman, P. and Thornley, A. (1996) *Urban Planning in Europe*, Routledge, London.

Oster, S.M. (1995) *Strategic Management for Nonprofit Organisations Theory and Cases*, Oxford University Press, New York.

Pfizer (2005) *Environment Transport Policy*, Pfizer. Visit www.pfizer.co.uk Last accessed 2 April 2005.

Reeven, P.V.; Vlieger, J.D. and Karamychev, V. (2003) *BOB Airport Accessibility Pilot Final Report*, Erasmus University Rotterdam Transport Economics, Rotterdam, the Netherlands, 15 October.

Rye, T. (2002) *Travel Plans: Do they work?*, *Transport Policy*, 9(4), October, 287-298.

Sam, F. (2001) *Public-Private Cooperation Gives Benefits for Companies and Employees*,

VCC Schiphol, Airport Amsterdam Schiphol, EPOMM Workshop, Milano, 14 December.

Samii, R. (2002) *An Innovative Public-Private Partnership: New Approach to Development*, *World Development*, 30(6), 991-1008.

Schreffler, E.N.S. (1998) *Travel Demand Management Evaluation: Current practice and emergent issues*, TDM Innovation and Research Symposium – *Setting a Strategic Agenda for the Future*, *Transportation Research Circular*, 433, 87-96.

Stockley Park Consortium Limited (2004) *Stockley Park Transport Plan*, Stockley Park Consortium Limited, Uxbridge.

Tapestry (2003) *The Netherlands*, Deliverable 2: Annex B, Tapestry. Visit www.eu-tapestry.org. Last accessed 31 March 2005.

UKBIDs (2005) *Business Improvement Districts: Supporting Business and Industrial Estate Development*, Project, Literature, UKBIDs, 30 March. Visit www.ukbids.org. Last accessed 17 August 2006.

Verma, R. (2005) *Editorial – Operations Management in Not-For-Profit Public and Government Services Charting a New Research Frontier*, *Journal of Operations Management*, 23, 117-123.

Ward, J. (2005) Telephone Interview and Personal Communication, Transportation Coordinator, City of Boulder, Colorado, 11 March.

Acknowledgements

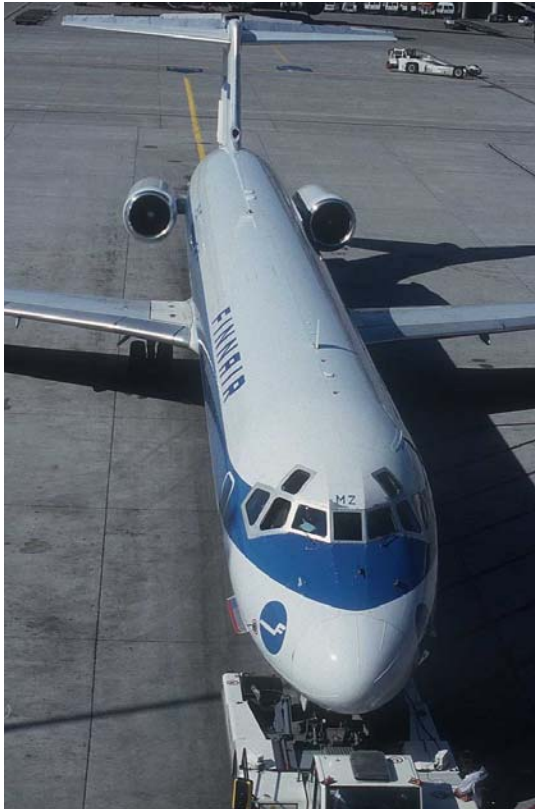
Thanks are due to the European Regional Development Fund Interreg IIIB programme-financed OPTIMUM2 Project and the London Borough of Southwark for sponsoring this research and the interviewees for their assistance in providing information for this

report. Finally, the authors are grateful for the advice of Dr Tom Rye of Napier University, Professor Stephen Potter of the Open University and in particular for the comments of Helen Pierce of Sustainable Energy Action, Sophie Tyler of Westminster University, Professor Peter Jones of UCL, and Diana Bunyan of the London Borough of Southwark.

Address for Correspondence:

Dr Marcus Enoch , Mr Lian Zhang and Dr Stephen Ison

Transport Studies Group, Department of Civil and Building Engineering, Loughborough University, Leicestershire LE11 3TU, UK.
Email: M.P.Enoch@lboro.ac.uk



Media Analysis of UK Aviation and Air Travel Stories

Lisa Davison & Tim Ryley

Individuals are flying more than ever before and over greater distances. Air travel has increased five-fold in the United Kingdom (UK) over the past 30 years, and demand is projected to be between two and three times current levels by 2030 (Department for Transport, 2003). Although this increasing demand has provided greater opportunities, there are environmental challenges to ensure that the development of aviation is more sustainable. The UK was set a legally binding target to reduce greenhouse gas emissions, to 12.5% below 1990 levels by 2008-2012. The UK is set to meet the Kyoto targets, partly due

to manufacturing decline, but increases in road transport and aircraft emissions (only domestic aviation emissions of CO₂ are accounted for in the Kyoto Protocol) need to be kept in check, due to their contribution to climate change. The Stern Review (Stern, 2006) calls for the aviation industry and air passengers to cover the external costs of air travel in terms of the cost of climate change.

On the other hand, it can be argued that although aviation is not environmentally sustainable, it is economically and socially sustainable (Upham et al, 2003). The development of airport capacity in the United Kingdom over the next 30 years has been set out in UK policy (Department for Transport, 2003; Department for Transport, 2006). There are some planned additional runways, such as at Heathrow and Stansted airports, but there is also emphasis on making better use of current capacity.

The review of UK media coverage presented in this paper is an initial research strand of the 'Propensity to Fly' research project, funded by EPSRC (Engineering and Physical Sciences Research Council, a United Kingdom funding body). The project examines individual responses to low cost air travel in the East Midlands region of the UK, primarily using data from a large household survey effort.

MEDIA ANALYSIS OF TRANSPORT STORIES

In the United Kingdom (UK), as in most countries in the developed world, individuals receive news information from the media in both traditional outlets such as newspapers, radio and television, and more modern communications methods such as the internet and mobile phones. The media is rapidly evolving, with increasing emphasis on individuals receiving information as instantaneously as possible. Transport is a major news topic area; a scan through the

pages of a local or national newspaper on a typical day will tend to reveal a transport story. A selection of topical transport examples within the UK media, over the last year or so, includes: safety on the railways, the effectiveness of speed cameras, a possible national road pricing scheme, the impact of transport upon climate change, rising petrol prices, and airport expansion. These transport stories relate to everyday travel, and many produce a strong reaction from the general public. For instance, the fuel tax protests of September 2000 were influenced by the media (Lyons and Chatterjee, 2003). As a result, many politicians and transport professionals fear the negative press associated with transport-related stories. There is, therefore, a need to understand in more depth the impact the media has upon its audience in relation to transport stories.

This paper is original and novel in the way it examines the rapidly growing communication and media environment, using a topical, transport application of aviation and air travel.

The entire study of mass communications is based on the premise that the media does have significant effects upon opinions and attitudes (Newbold, 1995). There are three major divisions within traditional mass media research (Katz and Lazarsfeld, 1995): research into the audience of a given communications message or medium; research enabling study of the language, logic and layout of communications

messages; and research into the impact of mass communications. This proposal focuses on the second aspect, the language, logic and layout of the communications messages, using air transport examples.

Most research on the interactions between transport and the media focuses on the media response to congestion charging (e.g. Gaber, 2004; Krause, 2004; Ryley and Gjerstoe, 2006); this paper focuses on a further transport case study of air travel and aviation during the year 2006.

A SUMMARY OF 'AVIATION' AND 'AIR TRAVEL' STORIES DURING 2006

LexisNexis is an on-line searchable archive of local and national United Kingdom newspapers. LexisNexis was used to locate the text from relevant articles, published during the period 1st January 2006 and to the 31st December 2006 inclusive. Up to five search terms can be entered per search and users can specify where in the document a search term appears, e.g. in the headline, near the start of the article, or anywhere, and how frequently the term is mentioned. They also have the option to restrict the time period of the search and the newspapers considered. For the purpose of the Propensity to Fly research project, 'aviation' and 'air travel', were entered as separate searches. Circulation figures for the 24 national newspapers within LexisNexis are shown in Table 1.

Table 1: Circulation figures for United Kingdom national newspapers (29/01/07 to 25/02/07)

Publisher	Title	Circulation figures
Associated Newspapers Ltd	The Daily Mail ¹	2,339,733
	The Mail on Sunday ²	2,263,980
Express Newspapers	Daily Express ¹	761,637
	Daily Star ¹	779,023
	Sunday Express ²	816,351
	Daily Star - Sunday ²	384,060
Financial Times Ltd	Financial Times ¹	445,276
Guardian Newspapers Ltd	The Guardian ¹	364,491
	The Observer ²	442,137
Independent Newspapers (UK) Ltd	The Independent ¹	264,182
	Independent on Sunday ²	239,585
News International Newspapers Ltd	The Times ¹	642,711
	The Sun ¹	3,072,392
	The Sunday Times ²	1,245,483
	News of the World ²	3,371,369
Newsquest (Herald & Times) Ltd	The Herald ¹	71,617
	Sunday Herald ²	54,366
Telegraph Group Limited	The Daily Telegraph ¹	896,476
	The Sunday Telegraph ²	667,692
Trinity Mirror plc	Daily Mirror ¹	1,564,082
	Daily Mirror / Daily Record ¹	1,976,926
	The People ¹	746,08331
	Sunday Mirror ²	1,374,786

Source: The ABC (Independent audit watchdog service for printed publications) <http://www.abc.org.uk/cgi-bin/gen5?runprog=nav/abc&noc=y> accessed April 11, 2007

Note: 1 = published Monday-Saturday, 2 = published on Sunday

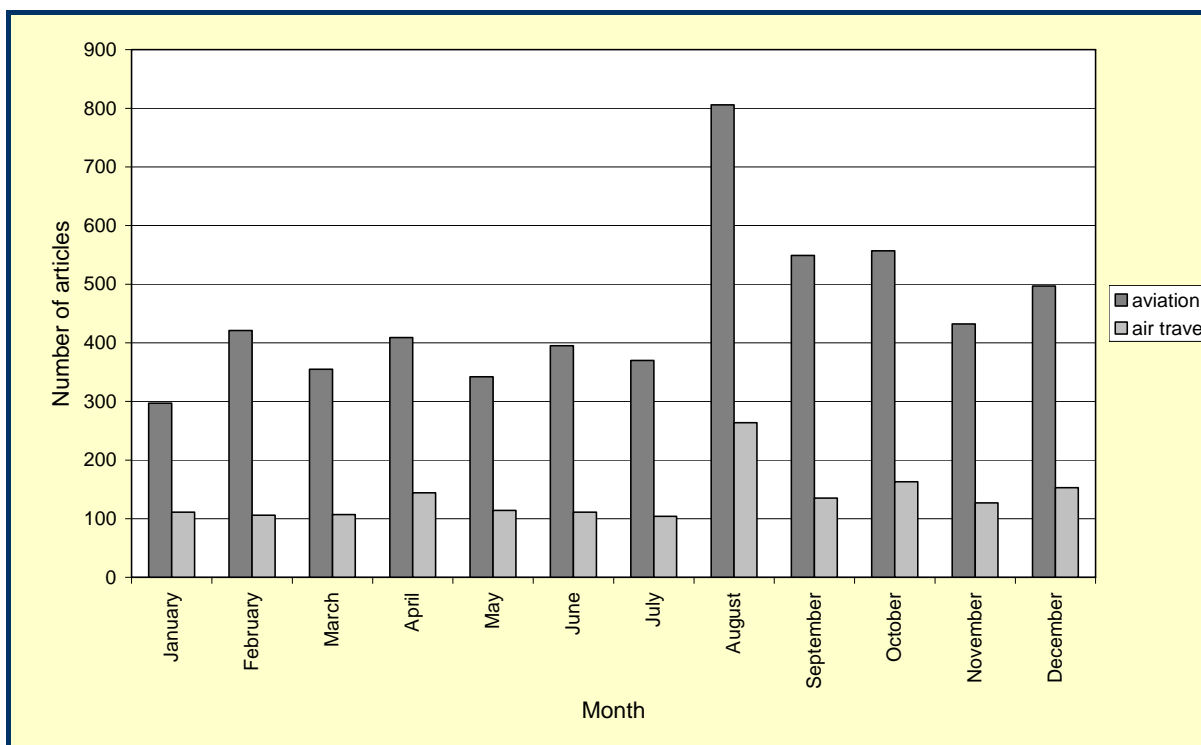
Discussion will differentiate between three types of newspapers: broadsheet, mid-market-tabloid and 'red-tops'. The standard classifications of newspaper are broadsheet and tabloid. The definition for broadsheet is (Oxford University Press, 2007): "A newspaper consisting of large, folded sheets, printed on both sides ...considered to contain serious, in-depth journalism ... now often contrasted with tabloid"; the definition of tabloid is: "A popular newspaper which presents its news and

features in a concentrated, easily assumable, and often sensational form, especially one with smaller pages than those of a regular newspaper". The subdivision of tabloid into mid-market tabloid and 'red-top' recognises the differing target markets of newspapers which would traditionally classed as tabloid papers; red-tops, referring to the red background on which the newspapers are printed, are a less demanding read than other tabloid papers.

The use of single separate search terms may mean that an article is considered more than once if it includes each term; however, using both terms provides a more comprehensive coverage. Figure 1 shows how the number of articles differs between 'aviation' and 'air travel' search terms by month during 2006. 'Aviation' appeared more frequently than 'air travel' throughout

the year, on average 444 and 136 articles per month respectively. There was greater variation in the number of articles including 'aviation'. Each show a media 'spike' during August, relating to the August 2006 security alert. The number of 'aviation' articles remained higher after this August spike.

Figure 1: Number of articles including the search term 'aviation' or 'air travel' by month during 2006



Source: LexisNexis

Table 2 considers coverage of the term aviation by type of newspaper, newspaper and month. Further exploration of the results by newspaper revealed that all except The People had elevated numbers of 'aviation' articles during August. This illustrates that the tabloid newspapers have

less coverage of new stories, with the example here of the security alerts. As expected, from the Table, the level of an aviation and air travel coverage decreases from broadsheet to mid-market tabloid and from mid-market tabloid to red-top tabloid.

Table 2: The number of newspaper articles containing the term 'Aviation' split by United Kingdom national newspaper and month during 2006

	January	February	March	April	May	June	July	August	September	October	November	December	Total
Broadsheet													
The Times & The Sunday Times	67	62	70	90	63	74	81	140	88	114	78	93	1020
Financial Times	54	84	62	55	70	70	81	90	76	90	86	77	895
The Guardian & The Observer	36	64	40	54	46	36	30	98	59	66	46	65	640
The Independent & The Independent on Sunday	25	47	38	44	32	46	48	104	102	54	49	44	633
The Daily Telegraph & The Sunday Telegraph	34	51	33	56	34	46	31	87	56	59	51	55	593
Mid-market tabloid													
The Daily Mail & The Mail on Sunday	27	49	52	42	40	51	40	86	52	62	45	61	607
Daily Express & Sunday Express	17	20	20	28	20	25	22	69	31	29	34	31	346
'Red-top' tabloid													
Daily Mirror & Sunday Mirror	15	21	18	19	19	22	16	60	43	36	16	34	319
The Sun	15	14	14	11	9	17	16	46	19	31	21	24	237
Other (Daily Star, Sunday Star, The People & Morning Star)	8	9	8	10	9	8	5	26	23	16	6	13	140
Total	297	421	355	409	342	395	370	806	549	557	432	497	5430

Source: LexisNexis

FRONT PAGE ANALYSIS OF 'AVIATION' AND 'AIR TRAVEL' STORIES DURING 2006

Due to the large amount of coverage of aviation and air travel stories during 2006, the analysis became restricted to front-page stories of UK newspapers. This was a more manageable process; for instance there were 225 front-page 'aviation' and 'air travel' stories during 2006. Articles were classified and coded according to the following primary themes:

- Advisory reports and political debate
- Aircraft development
- Airports, airlines and route development
- Security alerts
- Air travel and the environment

The review of media coverage considers each theme in turn. Some articles could be considered under more than one theme. For instance, the advisory reports and political debate theme considers air travel and the environment. Security, whilst considered in a separate category, has crossing-cutting effects, particularly with regards to airport and airline operations. The review prioritises items with the most extensive coverage and considers the response of different newspaper types.

Advisory reports and political debate

The two primary advisory reports reported in the newspapers were the Stern Review (Stern, 2006), released October 30, 2006, and the Eddington Report (Eddington, 2006), released December 1st 2006. Both represent a growing trend by the United Kingdom Government to commission political advisors to review a subject and produce a report. The Stern Review argues that protecting the environment is essential to the economy. The Eddington report presents the case that congestion limits the UK economy and market forces should be used to encourage efficient use of infrastructure. Each argues that the external costs of transport should be

internalised, with implications for the aviation industry.

Many of the front-page articles relating to the Stern Review give an impression of impending doom in their title and initial paragraphs, either in terms of high taxes that might result (Daily Mail, October 29th 2006; Daily Telegraph, October 30th 2006) or the predicted global impact (Observer, October 29th 2006; Daily Mirror, October 31st 2006). For instance, the headline in the Observer (October 29, 2006) is: "£3.68 trillion: The price of failing to act on climate change: Landmark report reveals apocalyptic cost of global warming". Coverage in the Guardian (October 31st 2006) differs from the other newspapers, focusing widely on the need for global action, stressing the importance of all countries to sign up to the Kyoto Protocol. The newspapers, with the exception of the Daily Mail (October 29th 2006), present a balanced political view that action is needed. The Daily Mail highlights that while the report covers the likely impacts of climate change, it does not reveal what the Government plans to do about it. The Daily Telegraph, typically aligned with the Conservative Party, criticises the Labour Party Government for the falling proportion in revenue from green taxes. Though there was widespread agreement across articles that it will mean increased tax on motoring and air travel, in one example the lack of tax on air freight receives attention (Observer, October 29th 2006).

Following on from the Stern Review was the 2006 Pre-Budget Report (HM Custom and Excise, 2006), an annual report produced by the Chancellor of the Exchequer within the United Kingdom Government; at the time of the report the Chancellor was Gordon Brown. The Pre-Budget Report doubled levels of Air Passenger Duty (as from February 1st 2007), payable per passenger per flight on departure from UK airports at standard amounts differentiated by

distance and class. In the lowest class of travel, Air Passenger Duty increased to £10 for most European destinations and £40 for further a field. The increased levels of Air Passenger Duty were headline news across the broadsheets and mid-market tabloids. Whilst the mid-market tabloids tended to focus on the injustice of the new charges, a number of articles presented the proposals as limited when considering the demands of the Stern Review (Daily Telegraph, December 7th 2006; Daily Mail, December 7th 2006). The Daily Mail coverage became accusatory of the UK Government, stressing that it was a “stealth tax on family holidays”, and discussion centred on the difficulty for airlines to recoup their losses (December 9th 2006). While airlines claimed that it was the “poll tax of the sky” (the poll tax was an unpopular United Kingdom Local Authority tax in the late 1980s and early 1990s), business groups accused the chancellor of “tinkering”, and the environmental group Friends of the Earth stated that Gordon Brown “fiddles while the planet burns” (Daily Telegraph, December 7th 2006). This illustrates how different stakeholder groups can respond to and influence the media debate.

The media coverage of the Eddington report stressed the role of Rod Eddington as former Chief Executive of British Airways. Coverage in the Daily Mail (December 1st 2006) links the proposed airport expansion to support economic prosperity, and that the plans would “infuriate campaigners who oppose more airports and flights”. This tension, between the economic and environmental aspects of aviation, is evident in many of the stories analysed.

Much of the newspaper coverage relates to the three main United Kingdom political parties, the Labour Party, currently in power, and the two primary opposition parties, the Conservative Party and the Liberal Democrats. One front-page story related to the business and personal use by Labour Party politicians of private planes, amid increasing media debate on the

environmental impacts of frequent flying (Daily Telegraph, April 2nd 2006; Times, April 12th 2006).

A report commissioned by the Conservative Party was mistakenly published on their website; it included details of proposed tax changes (Guardian, October 19th 2006; Daily Telegraph, October 29th 2006). In the newspaper revelations, the Conservative Party was attempting to increase consumer taxes whilst reducing the tax burden on families. One taxation example suggested was a levy on air travel. Indeed, in March 2007 the Conservative party produced a Consultation document on the use of environmental taxes to reduce carbon emissions from aviation (The Conservative Party, 2007); these proposals include fuel tax on domestic flights and a frequent flyer tax.

Aircraft development

Several aircraft development business stories made front page news during 2006. The Financial Times in particular (as well as the Daily Telegraph and the Mail on Sunday), considered the BAE sale of Airbus to the Franco-German-Spanish aerospace giant EADS to be front page news; the Airbus sale subsequently went through. Business supplement coverage extended from April (when the bid was first announced) until October; articles considering changes to the management structure, the impact it is having on UK jobs and the how it had effected countries contributing the aircraft development. Linked front page stories concern the debut UK flight of the Airbus A380 (Financial Times, May 19th 2006) and subsequent delays in Airbus A380 production (e.g. Daily Telegraph, June 14th 2006). Discussion often focuses on competition between Airbus and Boeing (e.g. Daily Telegraph, January 9th 2006), including relative sales figures and revenue, and the role of emerging aircraft markets such as China.

Airports, airlines and route development

Between February and June 2006 the prospective Ferrovial (a Spanish construction company) takeover of BAA (a major airport company, currently owning seven UK airports including Heathrow and Gatwick) was debated in the news, featuring heavily on the front pages of the business supplements of the Daily and Sunday Telegraph and the Sunday Times; receiving mention in the Financial Times, the Observer and the mid-market tabloid the Daily Mail. The Ferrovial consortium completed the takeover of BAA in June 2006.

Flotation of Aer Lingus, the Irish airline, received extensive front page coverage in the Sunday Times business supplement from February through to October 2006 and the 'City' section of the Daily Telegraph during August and December. Articles considered the low price requested for the airline and the competitive position given to UK and Irish airlines; later articles considered Ryanair's interest in the company.

Plans for Heathrow Airport were considered in the headlines of front pages a couple of times during the year. Consideration in the Observer focused on environmental campaign groups objections to the expansion (January 1st 2006), whilst towards the end of the year British Airways demanded Heathrow expansion, so the United Kingdom can keep a "competitive" edge (The Guardian, November 14th 2006). This is another illustration of the tension between the economic and environmental aspects of aviation, here in airport planning.

Security alerts

Coverage of the foiled bomb plot during August 2006 received the most widespread, intense and extensive coverage of all news items during 2006, as shown in Figure 1. The plot involved British suicide bombers intent on targeting planes above five US cities, through the use of

liquid explosives hidden in drinks bottles (Guardian, August 11th 2006). Initial reports focused upon the plot and terror suspects, considering or alluding to links between the individuals involved and other terrorist groups and incidences. The focus then turned to the increased security required at airports, in terms of inconvenience, cost and responsibility, and other contingency methods such as passenger profiling. The August 2006 security alert story featured on the front cover each of the three types of newspaper during the following two weeks. Broadsheet coverage was by far the most extensive, 23 articles compared to three mid-market tabloid and one red top.

The increased security measures and impact of airport efficiency gained increasing attention from August 13th onwards. The coverage, with few exceptions, considered the perspectives of the airlines, the airport authorities and the Government in relation to the effect upon individual travellers.

Each type of newspaper discussed the chaos resulting from the disruption; however the perspective and balance of arguments differ between types of newspaper. The tabloid newspapers focused mainly on airline criticisms. For example, the Daily Mail (August 14th 2006) ran the headline: "O'Leary's Fury at Terror Delays: Row over 'heavy-handed' security checks", focusing on Michael O'Leary's criticism (as Chief Executive of Ryanair) of the British Government and BAA. A similar argument between British Airways and BAA was mentioned in some of the newspapers (e.g. Times, August 14th 2006), although with less coverage; in defence of BAA, EasyJet and Virgin Atlantic provide support within some of the articles.

Emphasis in the news ranged from criticism of the security measure requirements and subsequent delays, to the monetary cost to airlines and who should be responsible for

remuneration. Costs to airlines were estimated at £50 million per day, according to a "senior industry source" (Daily Telegraph, August 15th 2006); amounts would differ by airline. Ryanair was portrayed as having the most aggressive stance (e.g. Daily Mail, August 14th 2006), consistently criticising government decisions and threatening to sue. Virgin Atlantic was portrayed as more pragmatic than either British Airways or Ryanair; the Daily Telegraph (August 15th 2006) quotes Paul Charles of the airline: "we need a sensible debate with BAA to work out how these costs can be shared". An Observer article (August 20th 2006) speculated that criticisms of BAA will lead to the break-up of Heathrow, Gatwick and Stansted; however, the Financial Times (August 25th 2006) reports that if a break-up would only occur on grounds of competition.

Coverage in the Financial Times (August 15th 2006) differed from the other newspapers. The article's main focus was the implications for business travellers. The ongoing restrictions on cabin baggage were seen as restrictive for business people "travelling with just a suit carrier and briefcase." Later Financial Times article considered the inconsistency between security in different EU airports (August 19th 2006) and disagreements between UK and US in terms of the level of security required given the delays to passengers (September 16th 2006).

A suggestion to make the security process less disruptive was to introduce selective searching as a result of passenger profiling. The Daily Mail (August 14th 2006) was the newspaper to moot the idea of passenger profiles on a front page, using Michael O'Leary's comments to support the idea that only 25% of all passengers be subject to the high level security measures, selected by potential risk. The Guardian provided an alternative view (August 15th 2006): a warning to the Department for Transport that introducing passenger profiling could be used to single out Muslims for security

checks, alienating the community that they most need help from, should they want to "combat the terrorist threat".

Aside from the August 2006 security alert, there were other front page newspaper articles relating to security concerns. Such concerns included speculation that air travel related to the London 2012 Olympics would be a target (Guardian, January 20th 2006), and concerns that private jets may be used in terror attacks (Financial Times, June 20th 2006). There was also discussion of the US identity card system (Observer, August 29th 2006) and a bomb hoax which resulted in delays for passengers (Sunday Times, August 16th 2006).

Air travel and the environment

Much of the issues surrounding air travel and environment were discussed in the theme regarding advisory reports and political debate; this included the environmental impacts of frequent flying by politicians. This debate was expanded to focus on others promoting environmental concerns. The Independent (April 1st 2006) considered the environmental cost of air travel amongst politicians and the royal family, with particular reference to the Prince of Wales. The article criticised the fact that the Prince of Wales travelled extensively with his entourage and did not consider offsetting to mitigate his carbon output, despite being quoted that climate change "is the greatest challenge to men".

A final story of interest features the Chief Executive of Virgin Atlantic, Richard Branson (Independent on Sunday, April 2nd 2006; Financial Times, September 22nd 2006), who is providing investment and offering rewards for technology that will limit the environmental impacts of aviation. Virgin Atlantic are investing up to \$400m in factories producing environmentally friendly ethanol fuel, which they hope will be used for their trains and, potentially, their airplanes.

DISCUSSION AND CONCLUSIONS

United Kingdom (UK) media coverage of aviation and air travel stories during 2006 has been reviewed and analysed; much focus has been on links between aviation and the environment, and security issues centred on the August 2006 alert. Coverage of climate change has increased over 2006, together with the publications of related advisory documents and links to aviation. The August 2006 alert and the knock-on security and travel effects had widespread newspaper coverage and considerable impacts upon the aviation industry. Many articles during the security alerts sided with airlines and were critical of Government. Both of these issues show that media awareness and response is increasingly required in the aviation industry.

Aviation stories have continued to be widespread in the media during the early part of 2007, due to the development of green policies by the two main political parties. In mid-March, the Conservative party produced a Consultation document on the use of environmental taxes to reduce carbon emissions from aviation (The Conservative Party, 2007); these proposals include fuel tax on domestic flights and a frequent flyer tax. The UK Government also put forward for consultation a draft Climate Change Bill (HM Government, 2007), which would make CO2 targets binding.

The media analysis has shown that aviation communication messages received through the different types of newspaper varies considerably. The broadsheets cover more news and business stories; the mid-market tabloids tend to be more personalised, one-sided articles; the red-top articles provide more limited coverage. As has been shown by examination of the advisory reports and political debate, stories often have a political slant (political parties tend to be very critical of each other) and some UK newspapers have an

alignment to a particular political party (not linked to the type of newspaper, broadsheet or tabloid). Some newspapers, such as the Guardian, often held a more global view than others. It was also of interest that many aviation-related business transactions make the front-page news, albeit in the business orientated newspapers. A recurrent issue in the media stories was the tension between the economic and environmental aspects of aviation; this is often difficult to reconcile.

This study has examined the communication messages of aviation and air travel stories. It has shown several media analysis difficulties: the volume of coverage ensured a focus primarily on front page news, and the rapidly changing media news environment can make media analysis date very quickly (many of the stories analysed have since been resolved). In the longer-term, it would be of interest to investigate the effect of (air) transport stories in the media have upon public attitudes, and the impact of these (air) transport stories upon (air) travel behaviour.

Finally, the media and communications environment is changing rapidly, both in the UK and elsewhere, and it is important for associated research and the aviation industry to keep up-to-date with the changes, particularly as more media outlets are used by individuals to receive news stories (e.g. the internet, mobile phones).

References

The Conservative Party (2007). Greener skies: A consultation on the environmental taxation of aviation, March 2007. [www.conservatives.com/pdf/greener skies consultation.pdf, accessed 17th August, 2007]

Department for Transport (2003). The Future of Air Transport. Air Transport White Paper, HMSO, London, December 2003.

[www.dft.gov.uk/about/strategy/whitepapers/air/, accessed 17th August , 2007]

Department for Transport (2006). Air Transport White Paper Progress Report, HMSO, London, December 2006. [www.dft.gov.uk/about/strategy/whitepapers/air/aviationprogressreportsection/, accessed 17th August , 2007]

Eddington, R (2006). The Eddington Transport Study: The case for action, Sir Rod Eddington's advice to Government, HMSO, London. [www.dft.gov.uk/about/strategy/eddingtontstudy/, accessed 17th August , 2007]

Gaber, I (2004). Driven to distraction: an analysis of the media's coverage of the introduction of the London congestion charge. Unit for Journalism Research, Goldsmiths College, University of London, 2004.

HM Custom and Excise (2006). Pre-budget report notes. HM Revenue & Customs. [www.hmrc.gov.uk/pbr2006/pbrn-all.pdf, accessed 17th August , 2007]

HM Government (2007). Draft Climate Change Bill. HMSO, London, March 2007. [www.official-documents.gov.uk/document/cm70/7040/7040.asp, accessed 17th August , 2007]

Katz, E. and P.F. Lazarsfeld (1995). Between media and mass / the part played by people / the two-step flow of communication, in Boyd-Barrett, O. and C. Newbold. (ed) Approaches to media – a reader. Arnold, London.

Krause, H.M (2004). Media's role in value pricing implementation. Paper presented at Annual Meeting of the Transportation Research Board, Washington DC, January 2004.

Lyons, G. and K. Chatterjee (2002). (eds) Transport lessons from the fuel tax protests of 2000. Ashgate, Aldershot.

Newbold, C. (1995) The media effects tradition, in Boyd-Barrett, O. and C. Newbold. (ed) Approaches to media – a reader. Arnold, London.

Oxford University Press (2007). The Oxford English Dictionary, on-line version. [www.oed.com, accessed 17th August , 2007]

Ryley, T. J. and N. Gjersoe (2006). Newspaper response to the Edinburgh congestion charging scheme proposals, Transport Policy Volume 13, Issue 1, pp. 66-73.

Stern, N (2006). Stern Review on the Economics of Climate Change, HM Treasury, 30 October 2006 [www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_index.cfm, accessed 17th August , 2007]

Upham, P., Maughan, J., Raper, D., and C. Thomas (2003). Towards sustainable aviation. Edited book. Earthscan Publications Ltd.

Acknowledgements

The authors would like to thank the United Kingdom funding body the Engineering and Physical Sciences Research Council (EPSRC). The media analysis was undertaken as part of the EPSRC funded Propensity to fly project.

Address for correspondence:

Department of Civil and Building Engineering
Loughborough University
Leicestershire LE11 3TU
United Kingdom
Dr Tim Ryley – corresponding author
Tel: +44 (0)1509 223422
Fax: +44(0)1509 223981
Email: T.J.Ryley@lboro.ac.uk

Dissecting Bangalore Traffic

Akbar & Sudhir

Bangalore is considered one of the fastest growing metropolitan cities in India. It has grown from an area of 8 miles² in 1897 to 165 miles² in 1995 and is still growing exponentially. Bangalore has an estimated population of 6.1 million, making it the third largest city in India. The extent of the developed area has increased from 174.7km² (1971) to about 561km². The Intensity of the growth in Bangalore can be observed from its population density which, according to data compiled in 2001 was nearly 2985 people/km² (2001); whereas the national average is 329 people/km². This makes Bangalore one of the most populated cities in India. The road sector has been neglected for a very long time and the resultant congestion has developed to problematic proportions.

The high migration of people to the city has resulted in the creation of a truly metropolitan area. In fact, only 38.7% of people residing in the city are from Karnataka, whereas the rest have migrated from other parts of India. This high exponential growth was never expected and has thus resulted in demand-oriented growth of the city.

Bangalore has grown into a polynucleated radial city with nine road corridors forming the principal radial arms with concentric orbital corridors. The development of various suburban areas into traffic attraction zones has resulted in an exponential increase in private vehicle ownership. This has caused utter chaos in traffic movements. In subsequent sections the Bangalore

traffic condition is critically dissected for better appreciation.

DEMAND & SUPPLY

Land-use

When faced with high levels of migration and the establishment of a large number of companies, the government of Karnataka initiated policies that increased urban sprawl. Growth in Bangalore is an example of the Growth Pole theory. In order to decongest the city CBD areas, it limited the FAR in CBD area and liberated the restrictions in suburban areas thus leading to exodus of people and companies to the suburban districts. The resulting geometric form can be described as a polynucleated urban structure with development of a Subsidiary Business District (SBD) and a Peripheral Business District (PBD) around the city. In fact, Edwards (1976) and Peskin & Schofer (1977) have done much work on such forms and concluded that this structure holds much promise for energy conservation than any other spatial arrangements. However, such an arrangement fails to solve the congestion problem. It increases congestion on suburban ring roads as is evident in Bangalore today. The Governments response to growing urban sprawl and chaos was to retrace their steps by revising the Master Plan. The revised 'Master Plan 2015', prepared by the Bangalore development authority, increased the floor area ratio in the Master Plan from 2.5% to 3.25%. This is more than double the ratio that is allowed for builders at present and the plan therefore attracted criticism from conservative planners who believe that it

will lead to an increase in congestion in CBD areas. The conservative planners fail to realise that the development of such high-growth suburban regions generate both an increase in trip lengths and an increase in vehicle ownership to the detriment of public transport. In fact, other Asian cities have FAR ranging from 5 to 15 (25.1 & 2).

The intensity of growth in the subsidiary business district can be seen from the analysis of the increase in rental values

(Rs/ft²) of built up space. The growth rate computed was in order of 17% - 26%. In order to compare the intensity of growth with other cities, the author's have relied upon an Index termed 'RESIDEX' (an index on price movements in the real estate sector by housing finance regulator National Housing Bank (NHB)). Bangalore has shown more growth in the period 2001-2005 when compared to other cities of India (Table-2).

Table 1: Land Value Growth Rate

SBD (Bangalore)	2004	2005	2006	2007	Avg Growth Rate (%)
Richmond Town	5000	6500	7500	8000	17.35
Indira Nagar	3200	3900	5000	6500	26.69
Kormangala	3100	3800	4500	6000	24.78

* Basic data from Businessworld 14th May 2007

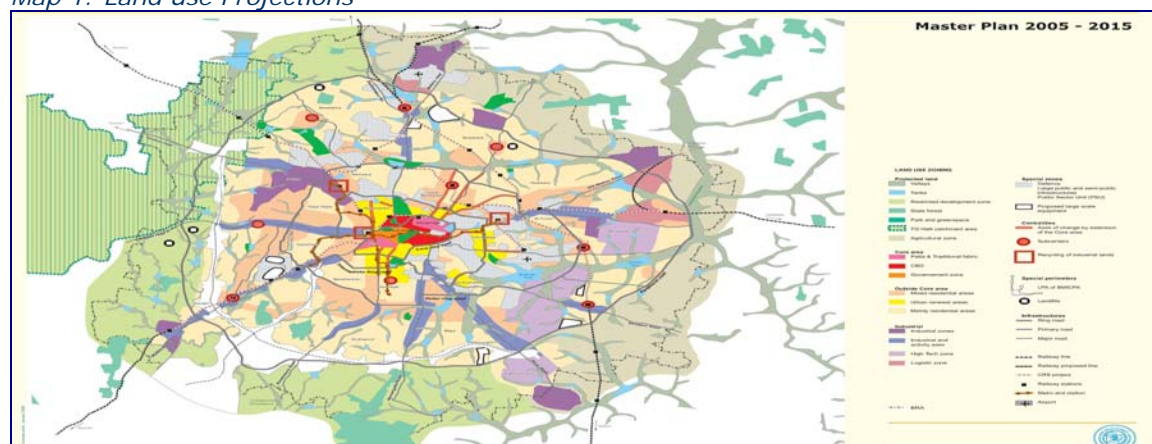
Table 2: Land Value Growth Rate (Residex)

City	2001	2002	2003	2004	2005	Avg. Annual Increase	Net Increase (2001-2005)
Delhi	100	106	129	150	201	19.1%	2.01
Mumbai	100	116	132	149	178	15.5%	1.78
Kolkata	100	115	129	148	172	14.5%	1.72
Bangalore	100	133	170	224	275	28.8%	2.75
Bhopal	100	120	136	154	179	15.7%	1.79

In order to formulate proper strategies, the government has proposed to form a 'Bruhat Bangalore Mahanagara Palike' (Greater Bangalore Municipal Body) merging the existing area of Bangalore City Corporation, 8 Urban Local Bodies

(ULBs) and 111 Villages of Bangalore Urban District thus increasing the planning areas to 1,306km². This increase in planning area would accommodate 8.84 million people (2015 projections).

Map 1: Land use Projections



* Source: Bangalore Development Authority

The above table indicates that the transportation component percentage has not increased in proportion to the increase in trip-generating land use percentages. The number of households in Bangalore according to the 'City Development Plan' (CDP) is 1,603,534. The Master plan indicates that around 375,000 new jobs would be created in emerging knowledge-based industries. In fact one study states that supply of around 7.5 million ft² of grade 'A' office space would be added in 2007 of which 5.5 million is in PBD. High job creation coupled with an increase in housing and population would exert enormous strain on the existing transport systems. Development of a new International

Airport at Devanahalli (North pivot) would generate development in Northern and Eastern areas of Bangalore city and would shift the focus from the present IT corridor. The Transportation sector component in such a high intensity land use growth scenario is insufficient. The Government is generating more traffic with this initiative based on supply intensive actions such as ring roads, flyovers and expressways. The best solution for such distorted demand is the need and establishment of a sustainable transportation system. The classic analysis of demand and supply will expose the Bangalore traffic scenario.

Table 3: Split in Land Use

Land-use	Area (Ha) 1963	%	Area (Ha) 1983	%	Area (Ha) 1990	%	Area (Ha) 2001	%	Area (Ha) 2011	%
Residential	3449	42.49	5777.65	28.48	9877.65	34.78	17123	40.40	24369	43.16
Commercial	175	2.18	634.07	3.14	675.07	2.38	1159	2.70	1643	2.91
Industrial	1006	12.52	1956.61	9.65	2038.61	7.18	29411	6.90	3844	6.81
Public and semi public	667	16.30	2533.64	12.49	2615.64	9.21	5201	12.20	4908	8.69
Park and open spaces	710	8.84	2050.16	10.41	2132.16	7.51	3520	8.20	7788	13.71
Unclassified	-	-	2114.24	10.42	2114.24	7.45	2164	5.30	2213	3.92
Transportation	710	8.84	5216.81	25.72	8946.63	31.49	10321	24.3	11697	20.71
Total	6717	100	20283.18	100	28400	100	42432	100	56462	100

*<http://www.bmrc.co.in/>

Existing supply

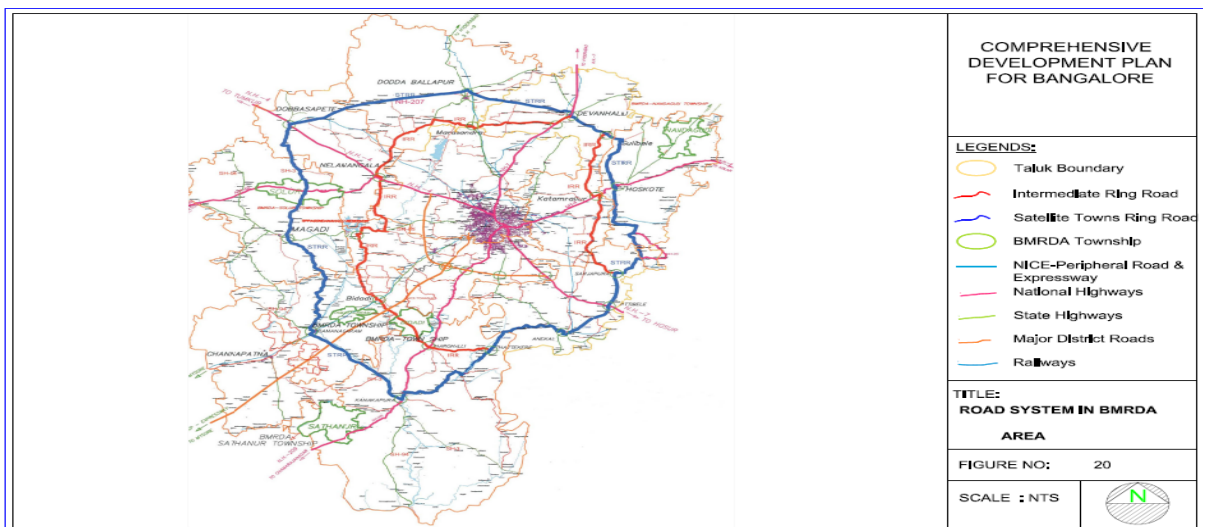
The city (BMP) has approximately 4,300 km of road connecting all the parts to each other in a radial geometrical pattern. The arterial road share in 4,300km is only 350km indicating not only a large km area of access roads but also high pressure on the arterial roads. In fact the arterial roads share in East, West and South sectors are 81km, 76km and 95km respectively. Bangalore has 38,000 intersections (162 signalised and 600 manually controlled) and 41,000 small roads.

The CDP (City Development Plan) prepared for Bangalore city lists the total length of roads in Greater Bangalore as 5,922km (all types). The CDP states that the length of roads are more or less in keeping with the proposed road norms barometer (mainly 8km per km² area, i.e. 299 km²) but the main problem concerns inadequate widths (27.33% of roads have widths of less than 4-lane).

demand management and not only supply actions as shown in CDP. A common trait in growing cities world-over is a tendency towards being car-dependent, yet ignoring the public transportation system. The resultant action of such a phenomenon is the poor level of quality (LOQ) of life and Bangalore is a prime example of this.

Major National Highways (Arterials) which pass through Bangalore City are the NH-4 (from Tumkur to Kolar), the NH-7 (from Anathapur to Hosur) and the NH-209. Apart from this, Mysore Road that forms the Bangalore-Mysore Highway Corridor is also part of the city's roads. Bangalore City also has major arterial roads such as the Kanakapura Road, Bannerghatta Road, Magadi Road and Sarjapura Road that connect Bangalore City to the other rural areas. Prominent CBD roads are - Sankey Road, M.G.Road, Cubbon Road, J.C.Road, Kempegowda Road, Sheshadri Road, Richmond Road, and Residency Road.

Map2: Ring Roads around Bangalore



The authors emphasise the fact that the proposed road norms should be aptly proportionate to the proposed land use, taking into consideration the aspects of

*Source: CDP-Bangalore-2006

The Master plan proposes that the major suburban areas (residential, commercial,

mixed land use and industrial) would be interconnected with several ring roads with variable nomenclature circumferencing the exits, proposed city limits and satellite towns. The proposal includes the development of ring roads with various nomenclatures such as the Core Ring Road (CRR), Outer Ring Road (ORR), Peripheral Ring Road (PRR), Intermediate Ring Road (IRR) and the Satellite Town Ring Road (STRR). The development potential would subsequently shift from existing IT - BT corridors to the ring road area with a subsequent increase of generated traffic.

Existing Mass Transportation Scenario

The city's irregular geometrical pattern contributes to the poor share of the present rail mode. The main provider of mass transportation is BMTC (Bangalore Metropolitan Transportation Corporation). A Metro system has been proposed along some high-density routes.

- ***BMTC***

BMTC has a fleet of 4,583 buses, which generate approximately 60,860 trips per day carrying 3.5 million passengers. The total number of service kilometres is 910,000 million. In fact, the high pressure on the existing BMTC network is quite evident from the fact that the loading per trip is nearly 57 passengers (indicating poor LOS). Also, the number of average trips per day for a driver is nearly 5.5, with an average trip length of 36km (assuming ideal conditions of 4,583 buses with 60,860 trips carrying 3.5 million passengers by 11,099 drivers) indicating high stress on drivers. The official statistics match closely with the author's analysis, which shows that total trip length in a day by a BMTC bus averages at 227.98km.

BMTC have approximately 27 depots, 31 minor bus stations and 2,200 wayside bus shelters. The average distance between such prominent shelters is 2.69km. Such high access lengths force passengers to utilise the intersections and mid-blocks for boarding and alighting which causes accidents and incident congestion.

BMTC has the merit of being the first in India to implement high capacity bus systems (HCBS) having high LOS. These HCBS's offer excellent in-vehicle LOS yet charge appropriately (less subsidies). The BMTC has intelligently placed AC-VOLVO services along 13 routes (IT & BT corridor) catering for the public most likely to board it.

- ***Bangalore Metro***

Elevated congestion levels have led the Karnataka Government to devise capital-intensive projects to alleviate the problem. One of these capital and capacity intensive plans is to implement a Metro system along the length of 33km. The per/km cost of the Metro system is nearly 1,938 million Rs. Phase I. is scheduled to be commissioned in December 2011. The authorities need to look for other, more economical plans which can be implemented with immediate effect.

- ***BRTS***

The Bangalore Development Authority proposes to implement a circular BRT of 72km in two phases on the outer ring road. The 'Bangalore Metropolitan Region Development Authority' (BMRDA) has promised to make all future ring roads BRT-compliant. In an alternate proposal, the 'Bruhat Bangalore Mahanagara Palike' (BBMP) together with the Bangalore Development Authority plans to introduce

25 light BRT grid routes that will connect areas within this circle. Though the physical groundwork has not yet started, the authors feel that if BRTS plans are properly implemented (specific feasible corridors such as ring roads with adequate widths) it would provide some relief as we have seen in many other cities. Other researchers agree that BRTS are not feasible on all streets due to the fact that factors such as corridor widths, existing LOS, number of junctions, number of grade separators and existing mode split with flow direction are the major pivotal points.

Existing demand

Exponential growth of the city has led to a significant rise in the number of private automobiles and an increase in trip lengths. Soaring population numbers and high density indicate that the load on the existing supply is very high. In order to investigate the total demand, Traffic vehicle registrations in Bangalore were analysed as represented in Table 4.

Such a high increase in the number of private automobiles is due to unplanned growth of the city and sizeable increases in disposable income. The high-tech explosion has led to the city playing host to nearly 1,154 software companies. Bangalore houses nearly 40% of India's IT sector. Many surveys have pegged per capita income to 290,000 per annum, which is the highest in the country. The high increase in vehicle ownership has led to spiralling congestion on the city's roads.

The other contributing factor when estimating total on-road vehicles is the high number of migrants. These migrants bring their own vehicles, registered elsewhere, into Bangalore thus

compounding the problem. Though migrants from other states have to re-register their vehicles in Bangalore, migrants from Karnataka state need not re-register. With a large migrant population and fewer numbers of people moving out of Bangalore, the basis considered in CDP for estimating the total number of vehicles by considering registrations in Bangalore is grossly underestimated.

The CDP states that the number of vehicles per household has increased to nearly 1.7 (2005) from 0.3 (1980). An Economic review (2005-2006) of Karnataka state gives the 2001 census details regarding vehicle ownership. It indicates that 29.8% of households have bicycles, 32.77% have two-wheelers and 9.18% possess a car. The number of vehicles on the roads in Bangalore can be predicted from the number of households (CDP) and the ratio 1.7 which provide an approximate estimation of 2.7 million. According to a recent study, congestion has reduced travel speed from 15-18kmph to less than 10kmph in 2001. Peak hour traffic volumes were recorded as follows: 10,000 vehicles in central zones, 3,000 – 7,000 in intermediate zones, and 3,000 – 5,000 vehicles in peripheral zones.

CRRI has estimated by-passable traffic in Bangalore to be around 1.69% of total traffic. This traffic will be diverted away from the urban traffic when the proposed ring road is executed.

Bangalore traffic police provide a traffic growth ratio of 2-4 in central zones, 5-7 in intermediate zones, and 8-9% in peripheral zones.

The author has tried to model vehicle ownership behaviour in order to project estimates in growth rate. Fundamentals of econometric modelling were utilised by developing the regression equation with the population (Bangalore zone) as the independent variable and vehicle registrations (Bangalore zone) as the dependent variable for the data for the 10 year period from 1995 to 2005. The resultant elasticity was 3.39 for two-wheelers and 3.75 for cars. Using this elasticity and a conservative population growth rate of 2.3 over the next ten years, the growth rate of vehicle registrations for two wheelers and cars were found to be 7.8% and 8.6% respectively. This growth rate is perfectly

logical (R2 of 0.99) considering the preference shown by the government towards supply intensive actions. Another study reported the vehicle growth rate of passenger vehicles as 8.4% considering the ADB guidelines for Bangalore zone. It has also calculated the elasticity of cars as 2.85 (2000-2005), 2.88 (2005-2010) and 2.91 (2010-2015) using the regression equations with vehicle registration with per capita growth rate. Since the year of study was 2001, less elasticity values are expected, as this does not take into account the economic stride which took place following the year 2001.

Table 4: Vehicle Registrations in Bangalore Zone

Year	Vehicle Registrations					Growth rate				
	2-Wheelers	M/Cars	A/R. Cabs	Others	Total	2W	M/Cars	A/R. Cabs	Others	Total
1980	97000	30000	10000	31000	168000					
1985	189000	47000	11000	30000	277000	14.27	9.39	1.92	-0.65	10.52
1990	401000	71000	15000	141000	628000	16.23	8.60	6.40	36.28	17.79
1995	594000	107000	34000	62000	797000	8.18	8.55	17.78	-15.15	4.88
1996	669000	121000	39000	71000	900000	12.63	13.08	14.71	14.52	12.92
1997	758000	138000	47000	80000	1023000	13.30	14.05	20.51	12.68	13.67
1998	839000	152000	54000	84000	1129000	10.69	10.14	14.89	5.00	10.36
1999	910000	164000	55000	94000	1223000	8.46	7.89	1.85	11.90	8.33
2000	994000	184000	58000	101000	1337000	9.23	12.20	5.45	7.45	9.32
2001	1092000	207000	62000	112000	1473000	9.86	12.50	6.90	10.89	10.17
2002	1183000	226000	64000	123000	1596000	8.33	9.18	3.23	9.82	8.35
2003	1323000	253000	69000	137000	1783000	11.83	11.95	7.81	11.38	11.72
2004	1444000	277000	76000	153000	1950000	9.15	9.49	10.14	11.68	9.37
2005	1570000	318000	75000	167000	2130000	8.73	14.80	-1.32	9.15	9.23

*Basic Data: <http://rto.kar.nic.in/bng-veh-stat.htm>

One study has related the per capita trip rate to 1.20, a conservative figure considering the high growth witnessed in the vehicle population. Bangalore claims to have one of the highest vehicle ownership levels in India - one vehicle for every three persons. This is due to

increase still further if not restrained through appropriate actions.

Mode split

Various researchers have conducted a number of investigations in order to model the trip-making characteristics of

Bangalore. The percentage of private automobile trips varies from 20% to 90%. The present mode split is especially oriented towards private vehicles.

The mode-split provided in the report by the BMRC (Bangalore Metro Rail Cooperation) favours private transportation, which states that 50-60% relates to two-wheelers and the rest to a combination of three-wheelers, cars and other modes. The Public Transportation

(BMTC) share is less than 2%. The mode split provided by BMRC is to be considered bearing in mind the motive of the project (vis-à-vis metro a new public transportation mode)

CDP-Bangalore gives the existing mode split in favour of mass transportation and plays down the threat (to some extent) of the booming private share of automobiles.

Table 5: Mode Split in Bangalore Zone

	A*	B*	C*(2001)	D*	E*	F*	G*	H*	I*	J*	K*
Two-Wheelers	75	48.3	29	5-10	30.40	58-62	29	50	40-50 (Bus: <2)	36	38
Car	15	26.4			4.56	15-18	15	20		5.5	
Auto Rickshaw	4	18.1			5.77	13-15	4	20		7	
Bus, Train/Light rail	1	3.1	45	30-40	40.96	2-3	52	5		49	41
Walk	-		16	42	16.26		-	-		-	17
Cycle			11	+ OTHERS	1.68		-	-		2	-
Trucks/LCV	3	4.1	-		-	2-5	-	-		-	-
Others	2		0	10-12	0.37		-	5		-	-

A*: Evaluation of traffic management

measures in Accident reduction under mixed traffic: Vivian Robert R. and A. Veeraragavan

B*: <http://parisara.kar.nic.in/PDF/Transport.pdf>

C*: ADB 2001

D*: [http://www.ucalgary.ca/evds/designresearch/projects/2000/cuc/tp/outreach/setty\(transportation\).pdf](http://www.ucalgary.ca/evds/designresearch/projects/2000/cuc/tp/outreach/setty(transportation).pdf)

E*: CDP-Bangalore-2006 (%)

F*: <http://www.simbaproject.org/download/india/Presentation%20and%20Feedback/Infrastructure/CRR1.pdf> -computed as % of veh-km

G*: <http://www.simbaproject.org/download/india/Presentation%20and%20Feedback/Infrastructure/CRR1.pdf> (future mode split)

H* sivaramakeishnan-urban mobility

I*: <http://bmrc.co.in/EIA.PDF>

J*: People Trips:

http://deepblue.lib.umich.edu/bitstream/2027.42/48792/1/FMFinal_121306.pdf

K*: <http://siteresources.worldbank.org/INTSARREGTOPTRANSPORT/Resources/UrbanTransportSectorStrategyNote.pdf>

Table 5 shows the differences between various studies. Such a high variation may be due to factors such as study area delineation, survey methodology, motive of study and sample size considered. Government policies modelled on such studies result in biased implementation. There is an urgent need to make realistic estimations of mode split covering the entire Bangalore zones.

The CDP quotes one of the studies where the free flow speed of private automobiles is calculated at 1.75 to 2 times that of public transport. This aspect needs to be addressed in order to increase the mode split of mass transportation. The viability of 'Demand'

shifting towards mass transportation can be predicted from the high percentage of private automobiles blocking the congested traffic lanes. Since the majority of people are choice-riders and not captive, the policies lean towards demand management which attracts and increases the non-motorized and mass transportation share. In fact one (BMTC) survey analysed a total of 900 trip makers (sample size) where 455 choice riders had actually shifted from their own mode to BMTC Volvo services and 165 had shifted from intermediate Public Transportation mode (auto).

Pedestrian mode share is nearly 16%, which is less when compared with ideal mode split for sustainable Transportation with a high level of quality of life.

The Ministry of Urban Development, Government of India, New Delhi 1998 published a report on Traffic and Transportation Policies and Strategies in Urban Areas in India, which states ideal mode splits for cities like Bangalore. The Ideal Transportation sector in a city has a mass transportation share of 70-85%, 15-20% bicycles share with 10-15% share of other modes. It is of interest to note how such ideal share is achieved and what kind of demand management techniques could be implemented for that kind of split. Authorities are banking on

Metro and Park & Ride concepts to change the split. Concepts such as park and Ride would attract and improve the mass transportation share, but would reduce the walking share, as people would be more inclined to use vehicles for ingress and egress, which in the long run may not help. Implementation of a Metro system along 33km, with Park & Ride facilities, would attract (compete & not complement) a major share from BMTC rather from private automobiles. Pedestrian facilities and mode share is shown in subsequent sections.

ACCIDENTS

India pays a high price for the number of annual accidents; around 3% of GDP every year. Bangalore, being a fast-developing city, claims a significant share of total accident figures. In fact, Bangalore is responsible for 10% of all accident-related casualties in Karnataka. Underreporting is a vital factor which needs to be considered when analysing the official data. A study has concluded that almost 800 people are killed annually and over 6,000 are injured in road crashes in Bangalore. According to the study, nearly 25% of deaths go underreported.

Table 6: Accident Growth in Bangalore Zone

Year	Accident Details				Growth Rate			
	Fatal	Killed	Non-Fatal	Injured	Fatal	Killed	Non-Fatal	Injured
2001	668	703	8358	6929				
2002	783	820	9073	7577	17.22	16.64	8.55	9.35
2003	843	883	9662	7980	7.66	7.68	6.49	5.32
2004	875	903	8226	6921	3.80	2.27	-14.86	-13.27
2005	793	833	6782	5899	-9.37	-7.75	-17.55	-14.77
2006 (upto 30.11.06)	776	809	6051	5457	-2.14	-2.88	-10.78	-7.49

[Basic data:](#)

www.bcp.gov.i/english/trafficpolice

Official statistics show a decrease in the accident growth rate, but still the



Potential accident spots due to poor drainage design and unscientific manhole cover used in Bangalore roads



accident density is very high: 0.14 deaths/km (2005) and 1.14 non-fatal accidents/km. The combination of varying traffic types and the limited width of roads results in vehicles violating individual spaces thus contributing to a high number of accidents.

In order to make proper conclusions and comparisons, the author's have computed accident Indices for Bangalore City.

Table 7: Accident Indices for Bangalore

Year	Registered Vehicles	Population	Total Accidents	Persons Killed	Persons Injured	FR	F-Risk	AR	ASI	A-Risk
1990	628000	4036000.00	6729	562	5677	0.89	13.92	10.71	8.35	166.72
1998	1129000	5471484.31	8360	726	6358	0.64	13.27	7.40	8.68	152.79
2002	1596000	6333505.00	9856	820	7577	0.51	12.95	6.18	8.32	155.62
2003	1783000	6501342.88	10505	883	7980	0.50	13.58	5.89	8.41	161.58
2004	1950000	6673628.47	9101	903	6921	0.46	13.53	4.67	9.92	136.37
2005	2130000	6850479.62	7575	833	5899	0.39	12.16	3.56	11.00	110.58
2006	2544573	7032017.33	6827	809	5457	0.32	11.50	2.68	11.85	97.08

* FR- Fatality Rate

F-Risk - Fatality Risk

AR - Accident Rate

ASI - Accident Severity Index

A-Risk - Accident Risk

From the table it can be inferred that the 'Accident scenario' in Bangalore is simulating the international cities decreasing trend phenomenon. The fatality rate has decreased at an average rate of 11% over the past 4 years. This

should not be considered as an achievement however, since continuity of the existing trend combined with a vehicle growth rate of 3% (at a conservative estimate) would only produce a 'zero' fatality rate result in

2083. Similar trends can be seen in fatality risk, accident rate and accident risk. The other serious concern is the upward trend in the accident severity index. This is very important as it means that accidents are becoming more fatal over time. The authorities should seriously consider this aspect. Possible hypotheses behind these trends are the supply-intensive actions of the Government and more night time driving. The high night time fatality rate is increasing the accident severity index. Due to a lack of adequate data, the author could not prove this hypothesis. The authorities must seriously consider the need for large reductions in

accidental deaths in order to establish sustainable community living.

TRAFFIC ENFORCEMENT

The high density of junctions affected by congestion, coupled with the fact that private automobiles are growing at an exponential rate, has led to an elevated number of traffic violations. Bangalore traffic police has not grown at the same rate as the growth in private automobiles.

The strength of Bangalore Traffic police as tabulated below indicates that the number of enforcing agents is very small when compared to the number of drivers.

Table 8: Staff Strength in Bangalore Traffic Police

	DCP	ACP	CI	PSI	ASI	HCs	PCs	TOTAL	Density (No/km)
Strength	2	8	33	147	59	287	1173	1709	0.29

*Basic Data: <http://www.bcp.gov.in/english/trafficpolice/aboutus/aboutus.htm>

The number of traffic violations can be seen at a glance from the number of official cases and fine amounts collected by the Traffic Police.

Within the Bangalore Police, only the officials with the post of Sub Inspector

and above can levy spot fines and book cases. Tables 6 and 7 show that the total amount collected in fines is very high when compared to the low number of fining authorities. This indicates gross indiscipline in traffic.

Table 9: Traffic Violations in Bangalore

Year	M.V.Act Cases	K.P.Act Cases	Towing Cases	Total Cases	Total Cases/km	Total Cases/day
2000	10,80,827	7,693	1,69,439	12,57,959	212	3446
2002	11,68,475	15629	136609	1320713	223	3618
2003	1132888	11736	123648	1268272	214	3475
2004	1053154	11133	33539	1097826	185	3008
2005	1575240	9962	61465	1646687	278	4511
2006 (30.11.05)	1411596	7865	78935	1498396	253	4486

*Basic Data: <http://www.bcp.gov.in/english/trafficpolice/aboutus/aboutus.htm>

Table 10: Fines Collected in Traffic Violations in Bangalore

Year	M.V.Act	K.P.Act Fine	Towing Charges	Total Fine Collected	Total Fine/Authority	Total Fine/Authority/day
2001	116008700	215360	18407950	134632010	540691	1481
2002	119054293	523709	14756950	134334952	539498	1478
2003	125417865	435299	13357550	139210714	559079	1532
2004	120154600	406325	4352400	124913325	501660	1374
2005	182631240	360250	12546900	195538390	785295	2151
2006 (30.11.06)	174479460	281225	16341100	191101785	767477	2298

*Basic Data: <http://www.bcp.gov.in/english/trafficpolice/aboutus/aboutus.htm>

Traffic discipline can be improved through increasing the fine amount (there have been no increases in fine charges since the year 2000). Hierarchy structures should be liberated in order to enable the authorities to gain more control over fines and the recording of violations. Dangerous driving and speeding are the most common cases

booked by the police as shown in Table 11, indicating the gross indiscipline shown by drivers cutting across all modes. The BTIS project launched by the Government may go some way towards solving these problems through efficient management.

Table 11: Type of Violations

Year	Dangerous driving	Over speeding
2003	73632	3776
2004	71607	4574
2005	128826	6589
2006	105009	4567
2007 - to March 31st	18584	901

*Basic Data: 17th may 2007-vijay times

VEHICLE INDUCED POLLUTION

The Transportation sector is considered to be one the chief contributors to rising pollution in urban areas and Bangalore is a prime example of this.

Several studies on pollution have showcased Bangalore as one of the most polluted cities in India. One study by 'Auto Fuel Policy' (2002) ranks Bangalore above bigger cities like Mumbai and Chennai.

Table 12: Estimated Pollution Load in Cities

Estimated Pollution Load in the Cities				
	CO	NOx	HC	PM
Delhi	421.84	110.45	184.37	12.77
Bangalore	207.04	29.72	117.37	8.11
Mumbai	189.55	46.37	89.93	10.58
Chennai	177	27.3	95.64	7.29
Hyderabad	163.95	36.89	90.09	8
Kolkata	137.5	54.09	47.63	10.8

*Source: Auto Fuel Policy, 2002

High exponential growth of vehicles has led to the severe deterioration of the environment. The following data (AQI) extracted from the EIA report (2003) for Metro substantiates the need for immediate action.

Table 13: Pollution in Bangalore (2003)(High Traffic Locations)

Name of Stations	Location	AQI values*	Off-Peak Noise Pollution (dB (A))	Remarks
Yeshwanthpur	North	256	92.25	Severe Pollution
Navarang Junction	North	148	96.06	Severe Pollution
Seshadripuram	Central	140	97.05	Severe Pollution
Anand Rao Circle	Central	189	100.56	Severe Pollution
National College	South	238	94.37	Severe Pollution
South End Circle	South	173	93.66	Severe Pollution
KIMS Circle	Central	146	95.18	Severe Pollution
Sri Aurobindo Circle	South	178	96.18	Severe Pollution
KIMCO Jn	West	256	98.68	Severe Pollution
Vijayanagar Tollgate	West	140	94.37	Severe Pollution
Okalipuram	Central	310	97.98	Severe Pollution
Anil Kumble Circle	East	76	86.15	Heavy Pollution
Majestic	Central	314	96.06	Severe Pollution
Trinity Circle	East	232	95.58	Heavy Pollution
Cauvery Bhavan	Central	241	99.43	Heavy Pollution
Old Madras Road	East	194	98.68	Heavy Pollution

*AQI > 75 Heavy Pollution, AQI > 100 Severe Air Pollution: Noise Pollution: permissible limit is 75dB

The above table shows soaring air and noise pollution indicating a degraded quality of life. The above table gives values from the year 2003. The condition of air pollution in February 2007 can be found in Table 14 which has been

extracted from Karnataka Pollution Control Board website.

CRRRI has estimated that private automobiles contribute 60% of CO², 30% of Nox, 55-57% of HC and 42-44% of PM in total pollution contributed by vehicles.

Table 14: Pollution in Bangalore (2007)

Location	SO ₂	NO _x	RSPM	SPM
Yeashwantpur	14.2	37.8	70	187
Peenya	14.7	32.6	100	208
Graphite India	14.2	37.3	199	455
KHB Industrial Area	13.8	35.5	83	219
AMCO batteries	14.3	34.3	54	184
Victoria Hospital	12.4	33.5	119	245
Permissible Limits (mg/m ³)	60	60	60	140

Table 15: Noise Pollution in Bangalore (2007)

Noisiest Spots	Permissible Level** in dB	Noise levels (in dB) (2007)	Increase in dB from 2002-03	Percentage Increase
Queen's Circle	65	87-91	12	200
Kempegowda Junction	65	89-94	12	200
Gandhi Bazaar	65	79-85	9	150
St John's Hospital	50	87-95	12	200
Martha's Hospital	50	88-96	2	200
Anand Rao Circle	65	82-87	6	100
West of Chord Road	65	83-87	10	170
MG Road	65	87-95	12	200

*Times of India-July-2007

** Day Time

A study conducted by NV Dynamics in Bangalore in 2007 exposed the health risks due to rapid motorisation in Bangalore. The percentage increase in noise levels was in the range of 200% with major locations exceeding permissible levels. The common recommendations by the Government-appointed committees and other experts (TEST-Bangalore) has been to ban shrill and multi-tone horns, amongst other measures; creation of green cover around the residential areas, provision of rubber beading to window and door frames (reduction of noise pollution by 80%), provision of a minimum of 3m space between property walls and footpath edges (reduction in 3dB) and disallowing heavy vehicles in the core

city areas (reduction of 26% in noise pollution). The author's have not unearthed any Government recommendation to ban vehicles altogether. The most viable solution for such problems is to recommend sustainable transportation options and this requires Government consideration.

According to a survey conducted by the Central Pollution Control Board (2003), the total vehicular pollution load released into the ambient environment was 1,145 tons/day in 1994. This had more than doubled to 2,662 tons/day by 2002. The study also revealed that out of the total pollution load, the proportion of CO² is the most abundant component of vehicular pollution at 60% followed by

HC (24.5%), NOx (13.5%), SO2 (1%) and SPM (1%).

Exposure to high vehicular pollution directly affects respiratory, nervous and cardiovascular systems in humans, resulting in impaired pulmonary functions, sickness, and even death. In spite of such a high pollution load and a vulnerable exposed public, the Government has not acknowledged the urgent need to reduce high vehicular growth.

Auto Fuel Policy 2002 (Chapter 6) has summarised some of the studies done in India on the effect of vehicle pollution on health. It has advocated strong research in this area for better planning, as the existing research is insufficient.

PEDESTRIAN & BICYCLE FACILITIES

Pedestrians are the most neglected mode in the entire traffic planning in Bangalore. Cities world over are changing their priorities towards pedestrians to make their cities more liveable. Pedestrians in Bangalore share their right of way with hawkers, animals and vehicles, which lead to a high number of accidents. With high trip lengths, the Pedestrian mode share of 16% is largely due to the significant bus share (ingress and egress).

Table 16 indicates the high accident indices for pedestrians. Figures recorded for pedestrians are very high, 31% and 41% injured & killed. This calls for the urgent intervention of authorities in separating the ROW of vehicles from pedestrians and the need for controlled crossings. One study (NIMHANS-97-98) has estimated that 15% of accidents involve pedestrians. The author's

analysis shows that 39 - 40% of pedestrians constitute total fatalities.



Traffic violation due to motorists driving on the footpath is the most common form of violation and often goes unaccounted because of the lack of enforcement authority. Other common causes of accidents are a lack of proper crossings, motorist's indifferent attitudes towards pedestrians and pedestrians crossing the roads at different locations. One study reported that restricting pedestrian crossings to designated locations has resulted in a 27% reduction in pedestrian accidents.



Poor pedestrian facilities coupled with poor enforcement and awareness education causes a high number of accidents and poor pedestrian mode split.

Table 16: Pedestrian Accidents

Year	Total Killed	Total injured	Pedestrians Killed	Pedestrians Injured
1999	639	6026	257	1921
2000	659	6347	273	1968
2001	703	6929	282	2199
2002	820	7577	328	2362
2003	883	7980	348	2967

*Basic Data: <http://www.hindu.com/2004/10/24/stories/2004102413300300.htm>

Table 17: CM's 10 Point Program (Pedestrian Consideration)

Description	Length/Location
Restoration of footpaths. Improvement of old/worn-out footpaths and restoration of footpaths where they do not exist. Removal and relocation of utilities that are present on footpaths to provide right of way to pedestrians	100km
Barricading of footpaths. Footpaths to be barricaded with openings only at strategic locations to regulate pedestrian movement, improve traffic safety and also pedestrian safety.	10,000 m
Pavement is raised by a smooth gradient so that vehicles have to slow down and pedestrians can safely cross the road, particularly with the help of pelican signals.	50 Locations
Pedestrian 'walk-over's'. to be provided in areas of high pedestrian activity	10 Locations

*Source: CDP-Bangalore-2006

Considering the seriousness of the issue, the Chief Minister has charted a "CM's 10 Point Program" in which pedestrian issues are considered. These are highlighted in Table 17.

The author's analysis shows that the proposals are cosmetic in nature. Only 1.68% of the footpath length is subject to improvements (on one side only), and a mere 0.16% of the total road length is destined for barricading.

CDP-2006 has made no major provision for sustainable transportation in Bangalore. High levels of pollution and supply-intensive measures with poor pedestrian facilities continue to degrade urban life.

Cycling as a mode of transport is virtually non-existent in Bangalore (insignificant share at 2%). The point to be considered

here is that nearly 29.8% of households have bicycles. This means that there are 477,853 bicycles in the city, which are constitute a 2% mode share. This is explained by the poor facilities available for cycling. Cycling is neglected by the Government, who cite poor demand as the reason why no supply is provided. Increases in trip length for work trips are the other main reason for this poor share.

The authors have investigated the entire city but failed to identify any good or prominent cycle tracks. Service roads are generally used as cycle tracks in Bangalore but the use of such roads by traffic escaping the congestion on main roads is becoming more commonplace, as are parking and un-parking manoeuvres which cause accidents. The high levels of air and noise pollution in Bangalore exert a pull towards non-

polluting modes such as cycling but with no government encouragement and publicity the Cycle-share may not increase in future.

One more aspect, which should be considered within the transportation sector of Bangalore, is the share of the Urban Poor. The urban poor population in Bangalore is between 14% and 25% with nearly 430,000 people residing in slums. This vulnerable group is most neglected during the planning stage. Though the government provides students/vulnerable groups with subsidised bus passes, elevated pedestrian movement where no footpath facilities are available expose them to high traffic levels. Increasing transportation costs and enhanced trip lengths are both factors which contribute to further decline in the already degraded life of the poor in Bangalore.

PARKING FACILITIES

Increases in private travel modes in Bangalore are exerting severe pressure on parking requirements. Provision of parking facilities can be seen both as a supply-based measure as well as a demand management technique depending upon the type of treatment provided. Insufficient parking places along with rapid growth of vehicles have contributed to haphazard parking by motorists, which causes accidents, traffic congestion and vehicle thefts. Bangalore not only plays host to the maximum number of vehicles stolen (30) everyday but also to nearly 10,000 parking violation cases booked in a month.

The number of vehicles per household is 1.7. With high land value growth, parking provision in households and other locations are not provided thus resulting in unauthorised on-street parking.

Garages provided in homes consume a lot of space and generate indirect costs. Such indirect costs owing to parking provision should be researched in order to justify demand management techniques.



The parking problem has been given due consideration in the Chief Minister's 10 Point Programme for Improvement of Bangalore City Traffic. This can be seen in Table 14. There is an urgent need to develop demand-based parking provision rather than free/low-charging supply-based provision.



Parking on 'no-parking' zones and on-street parking result in congestion, accidents and vehicle thefts.

Table 14: CM's 10 Point Program (Parking)

Component	Proposed Improvements	Key Stakeholders	Action
Park and Ride. Provide parking facilities at bus depots around the periphery and invite motorists to park and travel to the centre of the city by public transportation.	10 Nos.	Bangalore Metropolitan Transport Corporation/Karnataka State Road Transport Corporation	Demand Management
Restriction of On-street Parking. Identify roads/road stretches where on-street parking is to be prohibited.	50 Locations.	Bangalore Mahangara Palike, Bangalore Traffic Police	Demand Management
Mini parking lots/At-grade parking. Setting up of parking lots on vacant land owned by various Government agencies/BMP etc.	25 Nos.	Bangalore Mahanagara Palike, Bangalore Metropolitan Transport Corporation, Bangalore City Police	Supply-based Action

BANGALORE BTRAC PROJECT

Any paper on Bangalore Traffic would be incomplete without mentioning the ambitious BTRAC/BTIS Project. The Project is envisaged to transform the existing traffic scenario with an estimated investment of 3,500 million Rs. It is one of the first projects of its kind in India to make a huge investment in utilising the latest traffic management technology and demand management techniques to solve traffic problems. Some of the tools utilised in the project are 'Smart signals'; Smart Enforcement, Smart Information, Smart Helpline, Smart Response, Smart Public Transport, Smart Traffic Signs/Markings, Smart Safety Plans/Campaigns, Easy Auto etc.

One of the innovative ideas used in the Bangalore Traffic Information System Project is the use of cell phone congestion to estimate road traffic congestion. The system calls for the installation of micro-towers in selected congested areas at traffic crossings, which are taken care of by the service

provider Bharti Airtel. The information system monitors traffic densities, as indicated by cell phone signal congestion, to provide data in real time on the pattern of movements at different locations between the towers. The authors suggest that such an arrangement, although innovative, would not yield satisfactory results as cell phone traffic is unrelated to road traffic. Road traffic is heterogeneous with vehicles with different occupancy ratios. The data captured through the towers would be highly erroneous as it does not give mode splits. A junction with only 2-3 buses would show high congestion rather than a junction with an influx of 50 cars. Also, the roadside environment (ribbon/roadside development) would play a vital role in influencing the data. Instead, more investment could be made in the provision of interlinked videos and variable messages/signs connected to a control room along congested spots and distributed spatially along the region for better incident and traffic management.

FUTURE SCENARIO:**Is Bangalore a 'City of Future'?**

The above discussions affirm the fact that Bangalore at present has developed into a car-dependent city. In CDP-2015, the Government has quoted and planned major initiatives for converting Bangalore into an International Metropolis. The

Government has planned some smart growth initiatives such as the development of thirteen satellite towns and five major townships with "walk to work" and "play and work" concepts.

The CDP-2015 projects future land use growth as shown in the following Table:

Table 15: Future Land Use (CDP-2015)

Land Use	2003 (Km ²)	2011 (Km ²)	Net Increase (%)
Residential	159.76	243.69	52.54
Commercial	12.83	16.43	28.06
Industrial	58.83	38.44	-34.66
Open Spaces	13.1	77.88	494.50
Public & semi-public Uses	46.56	49.08	5.41
Public Utilities	2.49	-	
Offices & Services	4.27	-	
Transport & Communication	88.31	116.97	32.45
Unclassified	35.26	22.14	-37.21
Total	421.41	564.63	

The Government plans to increase both the intensity and the amount of residential and commercial blocks, which would generate and attract additional traffic. The Government plans to accommodate this traffic through increases in transport facilities. In the subsequent sections the future scenario of Bangalore is predicted.

Author's future vision

A closer look at travel behaviour, existing infrastructure and the city's development structure shows that Bangalore has the potential to be developed as a city for the future if the Government concentrates and positions the development policy in favour of a sustainable travel mode split. The following table highlights the sustainable mode split as suggested by the author.

Table 16: Future land use (CDP-2015)

Mode of travel	Present	Ideal Mode split*	Sustainable Transportation Mode Split**
Walk	16.26		20%
Bicycle	1.68	15-20%	20%
Bus & Other Mass Transportation	40.96	70-85%	50%
Two Wheeler	30.40	10-15%	10%
Car	4.56		
Auto-Rickshaw	5.77		
Other	0.37		

* Ministry of Urban Development, Government of India, New Delhi 1998

** Proposed by Author

The difference between the ideal mode split suggested by the Government of India and that proposed by the author is predominantly in the pedestrian component. Bangalore can only be labelled as the 'City for the Future' if the major transportation component is developed along the principles of environmental sustainability. As discussed earlier in the article, Bangalore is in a position to improve upon its cycling and walking shares provided it offers better infrastructure (cycle tracks and footpaths). The author has suggested some typical cross-sections (found in Appendices 1, 2 & 3 to this article) for encouraging sustainable mode split. These cross-sections are based on the concept that streets should be pedestrian-friendly and that the capacity-based (LOS) system of adding lanes is the main cause for car-dependency. The cross-sections have been developed for an Indian scenario for a Sub arterial, Collector and Local streets (Collector, Feeder and Access roads internationally) with a limited ROW of 50m, 30m and 20m. These cross-sections virtually reduce the width for private automobiles thus encouraging people to use sustainable modes for travel. The width provided for private automobiles can be reduced in stages in future to prevent opposition. The cross-sections should be applied based on the functionality of the road rather than considering the volume of traffic. Horizontal and vertical geometrics of the road should be 'forgiving" in nature. The speed through such cross-sections for private automobiles should not be more than 40kmph in sub-arterial streets, 30kmph in collector streets and 20kmph in local streets.

Options for a Mass Transportation lane would preferably be; BRTS/Bus lane/HOV (high Bus pooling in IT sector of Bangalore), taking into account economy factors and speed of execution. Depending on the type of facility provided, the width (appropriate for mass transportation) can be varied in order to provide safety features such as barriers for direction segregation. The cross-sections developed for limited ROW can be executed in key areas of the city without major constraints. The use of such cross-sections would be the first step in increasing the attractiveness of environmentally friendly modes and constitute a move towards sustainable living.

Government Vision

The Government action plan for the future is summarised in the table below. Great importance has been placed upon increasing the Supply. The Government plans to accomplish such a task with a major investment of 75.36 billion Rs over the master plan period in construction and maintenance.

It is to be highlighted that with such massive investment in supply-based actions, generation of car-based traffic cannot be neglected. In fact there is no major research on traffic generation for Indian conditions that can be quantified. In the famed NHDP Projects, executed by the Indian Government, many consultants assumed induced traffic levels (varying from 5%-10%). As these roads traverse rural areas and the assumptions are not based on serious research, the same cannot be predicted in a Bangalore scenario. However, considering the fact that there is a large volume of suppressed traffic (V/C of >1 for 52 Corridors/links CDP-2015), and

taking into account the present mode split and vehicle ownership figures, there is a potential for large generation of induced traffic.

Bearing in mind these aspects, there is a real probability of a “Boomerang Effect” taking place with supply intensive future action plans. Bangalore would continue to be a car-dependent city in future if such an action plan is executed.

Actionplan – 2015				
Government Strategy	Supply	Demand	TSM	High Induced Traffic
Elevated core Ring Road	✓			✓
Outer Ring Road	✓			✓
Intermediate Ring Road	✓			✓
Peripheral Ring Road	✓			✓
Satellite Ring Road	✓			✓
Improvement of Axial Roads	✓			✓
Grade Separators	✓			✓
Airport Expressway	✓			✓
Bangalore Metro Rail		✓		Possibility of Latent Demand
Commuter Railway System		✓		Possibility of Latent Demand
High capacity Bus Transport System		✓		Possibility of Latent Demand
Parking (Fees)		✓		-
BTRAC			✓	Possibility of Latent Demand

CONCLUSION

A meteoric rise in population numbers (both humans and vehicles) in Bangalore has resulted in spiralling growth in congestion on all the roads. The growth in vehicles has resulted in a loss in quality of life of citizens of Bangalore. An attempt has been made to collate a number of different data pertaining to traffic in Bangalore in order to provide a critical analysis which would expose the current scenario.

Some of the findings are as follows:

- ✓ Bangalore has seen the highest intensity of urban growth in India.
- ✓ Transportation Share in land use is nearly 20%
- ✓ FAR is 2.5% - 3.25%

- ✓ Bangalore Metro has a cost of 1,938 million Rs per km.
- ✓ The growth rate of private automobiles is 7.8% - 8.6%
- ✓ The mode split is in favour of private automobiles – approximately 40% and increasing
- ✓ Sustainable transportation share is approximately 60 and decreasing
- ✓ Cycling is the least used mode of transport at only 2%
- ✓ High accident probability - almost 800 traffic deaths/year (39% - 40% = pedestrian share)
- ✓ High traffic violations, almost 4,500 cases per day

The irony is that Bangalore, which was once named a ‘Garden City’, has

transformed into one the most polluted cities with escalating population growth and an ever-widening gap between the urban rich and poor people. It has one of the highest numbers of traffic violations in India with the highest number of black spots (knick-named in transport terminology as the "Black City" owing to the high density of black spots). The future of public and pedestrian safety in Bangalore looks bleak due to the proposed implementation of high-speed corridors. In order to provide safer transportation, speeds of private automobiles must be brought down.

The author has proposed a modified cross-section with reduced speeds for Bangalore city which, if implemented, would guarantee safer and ecologically sustainable transport facilities for Bangalore people.

The Government has relied upon supply-intensive measures with the predominate concept of "**Build to Sustain**" rather than "**Sustain for the Future**" which compounds the problem.

Bangalore continues to grow horizontally, vertically and in all directions with demand leading infrastructure growth. The future holds the key for researchers, providing them with a golden opportunity to study the travel characteristics of Bangalore people and to consider the contradictory demand and supply Government policies.

REFERENCES

Alain Bertaud, Jan K. Brueckner, April-2003- Analysing Building-Height Restrictions: Predicted Impacts, Welfare Costs, and a Case Study of Bangalore, India

Alain Bertaud: http://alain-bertaud.com/images/bangalore_FSI_Bertaud_Brueckner.pdf, last accessed 14 Aug 2007

Auto Fuel policy- 2002, http://www.petroleumbazaar.com/Library/auto%20fuel%20policy/ch_3.pdf

Bangalore's Boomtown Blues: <http://news.bbc.co.uk/2/hi/business/6288325.stm> , last accessed 20 Aug 2007

Bangalore City Police: <http://www.bcp.gov.in/english/trafficpolice/aboutus/aboutus.htm>, last accessed 4 Aug. 2007

Bangalore Metro Rail Cooperation Limited: <http://www.bmrc.co.in/>, last accessed 12 Aug.2007

Bangalore Metropolitan Cooperation: <http://www.bmtcinfo.com/english/index.htm>, last accessed 9 May 2007

Bangalore Metropolitan Region Developmental Authority: <http://www.bmrda.kar.nic.in/>, last accessed 12 Aug.2007

Bangalore Traffic Improvement Project: <http://www.btrac.in/benefits.htm>, last accessed 21 Aug 2007 & <http://www.btis.in/live.htm>, last accessed 20 Aug 2007

Business Standard, 2006, "[Bangalore most affluent market](#)", last accessed 23 Aug. 2006

Businessworld-India-14th may-2007

Central Pollution Control Board, http://www.cpcb.nic.in/Reports/default_Reports.html, last accessed 11 May 2007

City Development Plan- Bangalore: Bangalore Mahanagara Palike: <http://www.bmponline.org/Bruhat%20Bangalore/cdp.shtml>, last accessed 15 May 2007

Economic review – 2005-2006 (Karnataka State)

Evaluation of traffic management measures in Accident reduction under mixed traffic: Vivian Robert R. and A. Veeraragavan: <http://www.ictct.org/workshops/03-Soesterberg/Robert.pdf>, last accessed 15 May 2007

Global Road Safety Partnership: <http://www.grsproadsafety.org/?pageid=27#GRSP%20in%20Bangalore>, last accessed 12 June 2007

Hall, J.V., 1996. Assessing health effects of air pollution. *Atmospheric Environment* 3, 743–746.

Karnataka State Pollution Control Board: <http://kspcb.kar.nic.in/>, last accessed 15 June 2007

NV Dynamics: http://www.nvdynamics.com/Traffic_Noise_Survey.pdf, last accessed 15 Aug 2007

“Review of Urban Transportation in India”. Sanjay K. Singh. Indian Institute of Technology Kanpur-2005, <http://www.nctr.usf.edu/jpt/pdf/JPT%208-1%20Singh.pdf> , last accessed 20 Aug 2007

Research in Indian Road Infrastructure: State of the Art: <http://www.simbaproject.org/download/India/Presentation%20and%20Feedback/I>

[nfrastructure/CRRI.pdf](#) , last accessed 15 Aug 2007

Strategic Transformation of Ford Motor Company: http://deepblue.lib.umich.edu/bitstream/2027.42/48792/1/FMFinal_121306.pdf, last accessed 20-8-2007

Towards a discussion of support to Urban Transport development in India: Document of the World Bank- <http://siteresources.worldbank.org/INTSARREGTOPTRANSPORT/Resources/UrbanTransportSectorStrategyNote.pdf>, last accessed 30 June 2007

Traffic characteristics and demand along North-South corridors- A case study by Vijay Kumar-2001 (ME thesis-UVCE)

Urbanization and urban transport in India: The sketch for a policy: Sudarsanam Padam, Sanjay K. Singh: http://www.seas.harvard.edu/TransportAsia/workshop_papers/Padam-Singh.pdf , last accessed 10 Aug 2007

World Population Figures: http://www.mongabay.com/igapo/2005_world_city_populations/2005_city_population_01.html, last accessed 1-8-2007

About the Authors

N. Akbar (akbar@secon.in), M.Tech (Transportation Engineering) is working as a Project Coordinator in Secon Pvt. Ltd. a GIS driven Multidiscipline Engineering firm in India. He specialises in Highway Design and Construction supervision, Sustainable Transportation and Traffic Engineering aspects.

Sudhir (sudhir@secon.in), M.Tech (Transportation Engineering) is working as a Project Engineer in Secon Pvt. Ltd. a

GIS driven Multidiscipline Engineering firm in India. He specialises in Highway design, Traffic engineering and road safety aspects.

Address for Correspondence:

SECON Pvt Ltd.

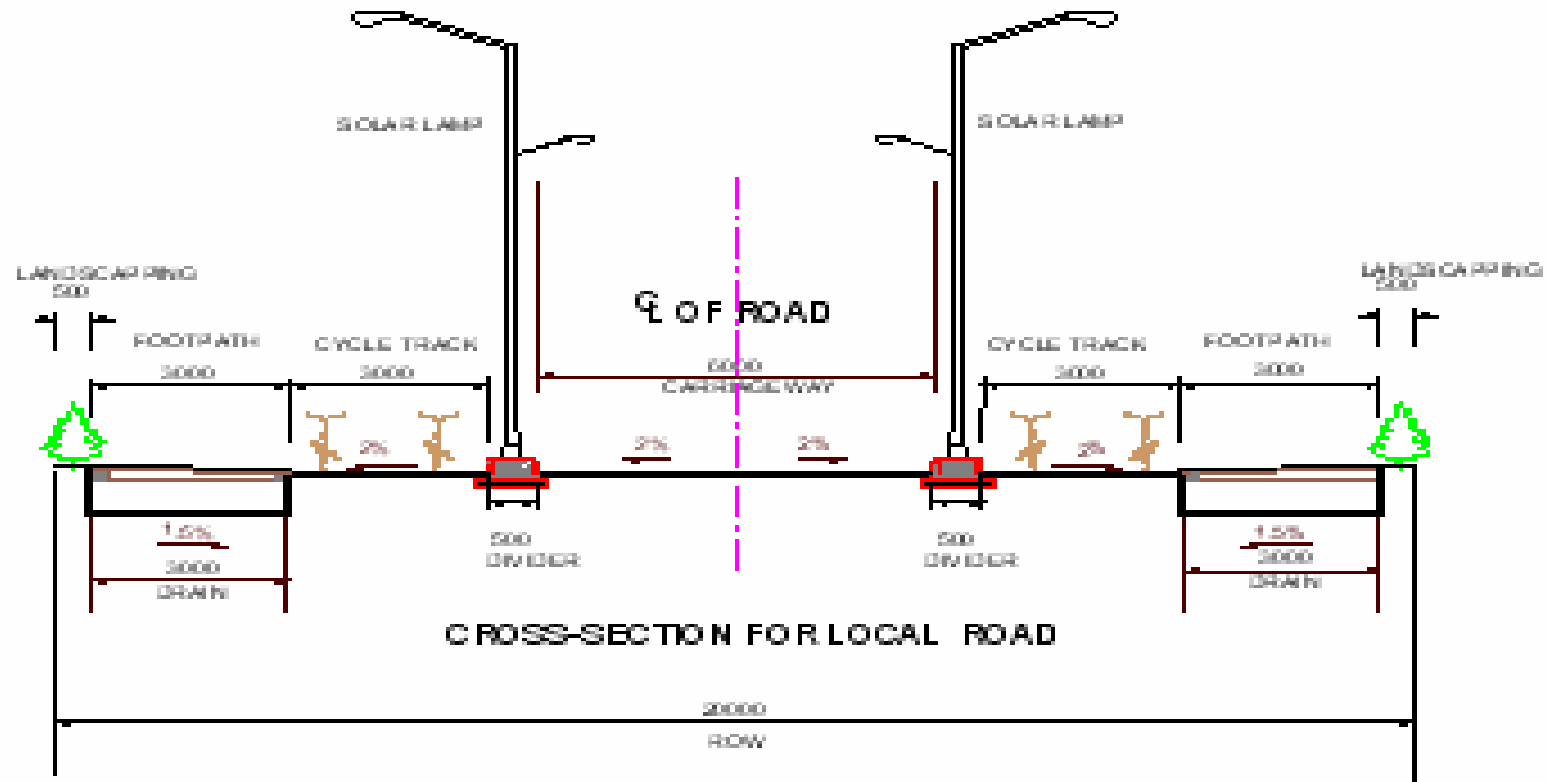
147, 7B Road, EPIP,

Whitefield, Bangalore 560066, India

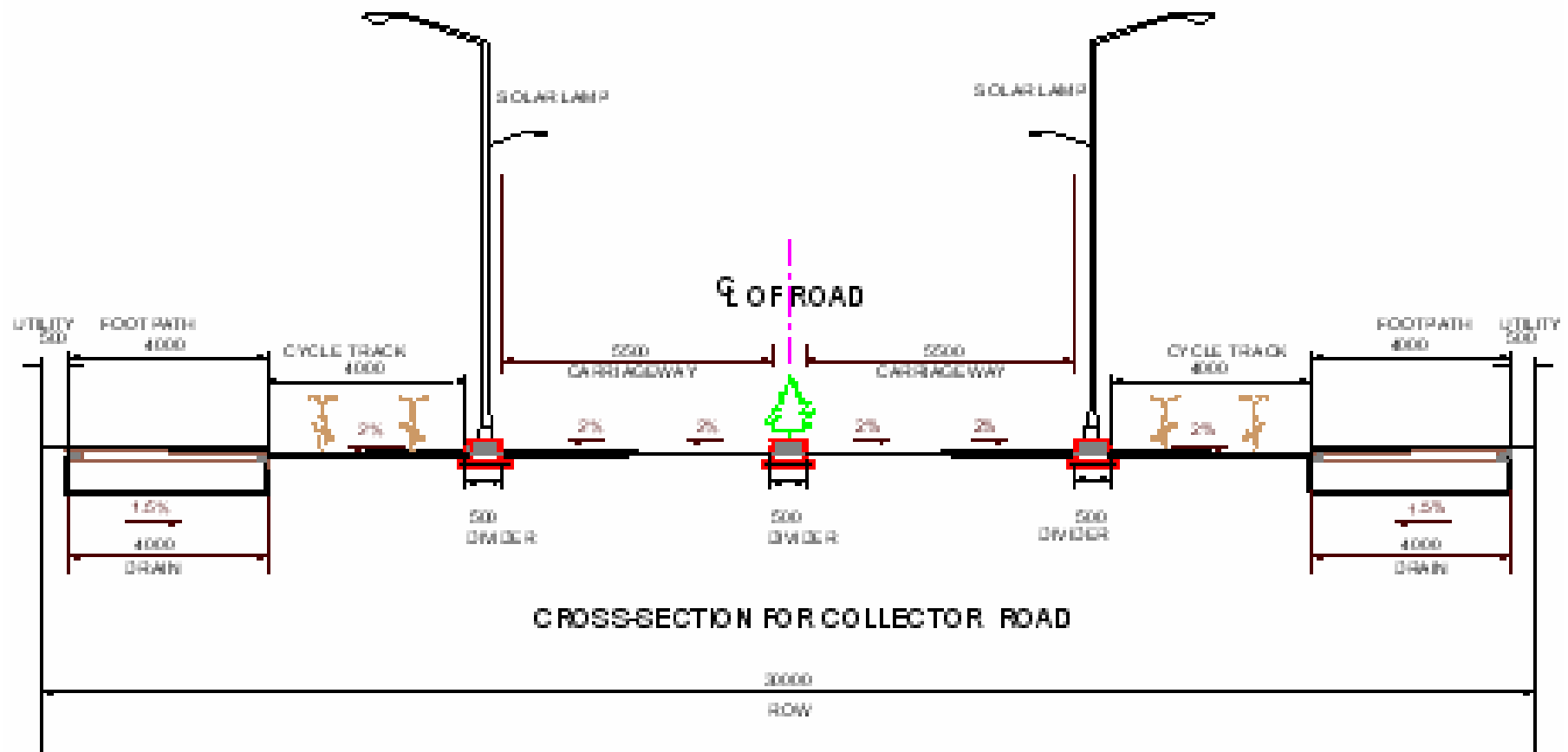
Phone: 080-41197778 (413)

Email: akbar@secon.in / sudhir@secon.in

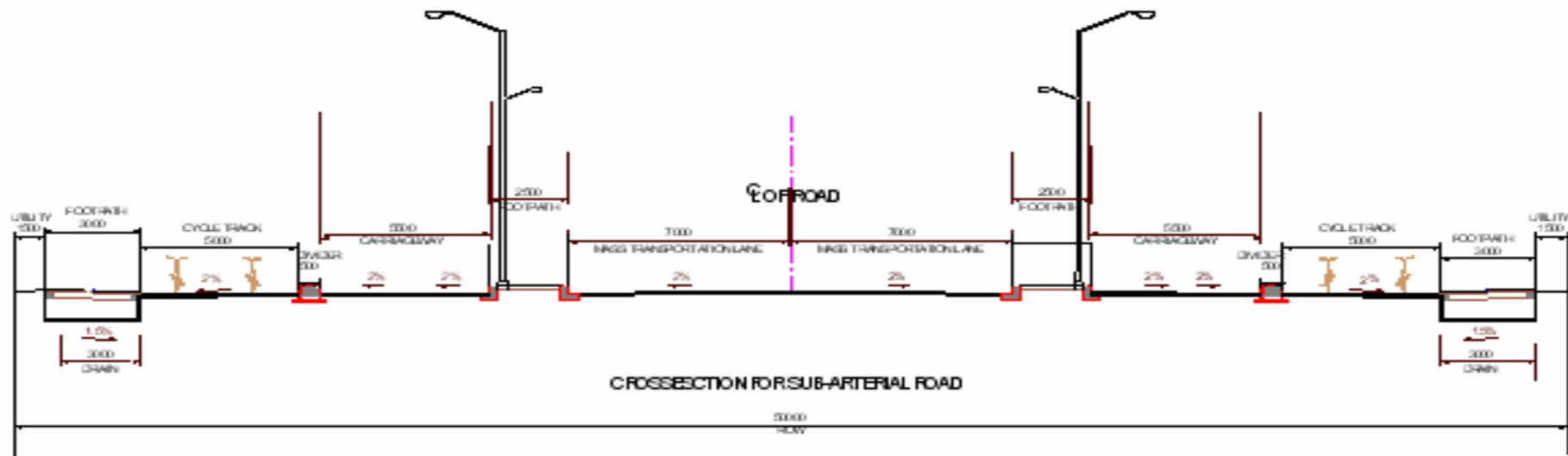
Appendix 1: Cross-section for Local Road



Appendix 2: Cross-section for Collector Road



Appendix 3: Cross-section for Sub-arterial Road



Exhausting the City: Implications of land use and transport in Perth, Australia

Ryan Falconer, Professor Billie Giles-Corti, Professor Thomas Lyons

Since WWII many cities in North America and Australasia have been shaped by innovations in housing, demand for suburban living and the emergence of the private vehicle as the favoured mode of transport. In Australia, land use and transport planning has been heavily influenced by US practice (Davison, 2004). During the post war period, land use planning focused on providing people with opportunities for low density suburban living. Concurrently, the personal, high speed mobility afforded by private vehicles allowed people to live further away from their places of work and from services. Residing within walking or bicycling distance of the facilities essential to one's life's work became unnecessary as did residing within easy access of public transport. As people moved further away from facilities and public transport they became more dependent on cars, with access to few local facilities and little opportunity to use alternative modes. The unprecedented urban sprawl and car dependence in cities such as Perth has created a reliance on oil for transport energy, various forms of pollution and more recently, a range of public health concerns (Frumkin et al, 2004; Newman and Kenworthy, 1999).

Significantly, this research takes a broad view of transport sustainability, using analysis of the literature to explain how

transport patterns are increasingly being linked with changes to the built environment, energy consumption, pollution and more recently, public health. Transport sustainability cannot simply be considered a function of affordability for the user. Given this broader conceptualisation, it is explored how urban systems and travel behaviour in Perth require redress. It is the need for redress that sets the context for a reformed policy agenda.

The paper culminates with analysis of two key reform strategies, Liveable Neighbourhoods and Travel Smart, which have been developed by Western Australia's State Government to facilitate more sustainable urban arrangements and transport behaviour. These strategies are significant, receiving international recognition for their potential to improve the outlook for the city. Our analysis highlights the importance of tailoring reform strategies to context: LN is a development strategy developed for Perth that nonetheless shares guiding principles with Smart Growth and New Urbanism, and Travel Smart is applied at the local level. Importantly, Travel Smart may also be a context-specific strategy to deal with discretionary car travel.

Central to Liveable Neighbourhoods and Travel Smart are the understandings that

sustainability is linked to mode use. It is shown in our discussion how public transport and active modes are relatively more sustainable than private vehicles. These modes require relatively less transport energy, produce less pollution, are more socially equitable, being either more affordable than cars or free and are linked with better public health (especially active modes) (Frumkin et al., 2004).

Planning for car travel – reflections of the US experience

Australia-wide, Gleeson (2006) describes the period from 1945 to the 1980s as being marked by convulsive growth in cities and economic boom conditions. The process of suburbanisation was aided by rapid motorisation and the War Service Homes Scheme, which financed land ownership and detached dwellings for returning servicemen (Gleeson, 2006). These processes and phenomena may have been more pronounced in Perth than elsewhere.

Perth has embraced suburban development much more strongly than other cities in Australia and its influence on lifestyle and quality of life is pervasive (Jones, 2003: p315)

Analysis of urban policy from this period suggests that it tended to be directive but not prescriptive about growth. This is despite there being regional planning strategies formulated in Australia soon after the war, such as Perth's Stephenson/Hepburn Plan of 1955. This plan formed the basis of the Metropolitan Regional Scheme (1963), which continues to be the statutory planning mechanism for the Perth metropolitan region. Ironically, the 'strategic' Plan – with its emphases on low development

densities (particularly outside of established nodes), segregation of land uses and a lack of a rigid urban growth boundary - provides the backdrop against which Perth's current problems associated with urban sprawl and car dependence have developed.

From early on in the period of rapid motorisation, Australia reproduced many US phenomena: the US was seen as the model of motorisation and provision of ancillary automotive services, including drive-in facilities, franchised petrol stations and extensive car parking (Davison, 2004). Many people rapidly came to rely on their car to conduct their life's work. What then precipitated such rapid motorisation? Until the end of World War Two, there had remained a considerable reliance on public transport. In Australia, this was attributable to shortages of fuel, the relative immaturity of both the market for private motor vehicles and the road network, and relatively concentrated urban development (Laird and Newman, 2001a). As an indicator, only one in every four households in Melbourne owned a car at the war's end (Davison, 2004). However, for many people public transport was a source of frustration, given shortcomings of services and following the war, cars became symbolic of freedom, mobility and opportunity (Laird and Newman, 2001a). Innovation, competition, mass production within the vehicle market and mass marketing undoubtedly helped both to sell the virtues of private motor cars and to reduce the price making them more accessible to the less affluent. At the same time, rising relative affluence in Australia as well as elsewhere in the developed world contributed to

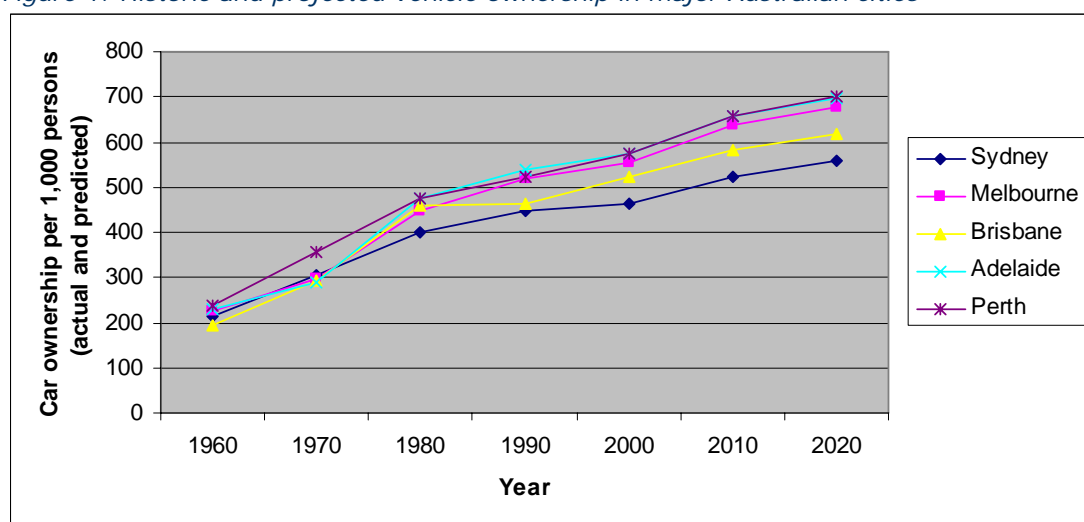
increasing car ownership (Cameron et al., 2004; Ingram and Liu, 1999).

From the early 1960s, the rapid uptake of motor vehicles can be monitored. In Perth, for example, Kenworthy and Laube (1999) detail a continuing upward trend in vehicle ownership per 1,000 people. In 1961, there were 239 passenger cars per 1,000 people, which rose to 357 per 1,000 in 1971, 475 per 1,000 in 1981 and 523 per 1,000 in 1991. Current levels of ownership are estimated to be between 630 cars per 1,000 (Cameron, 2004) and 679 per 1,000 persons (Ashton-Graham et al., 2005). Car ownership has likewise spiralled upwards in other Australian cities (Newman and Kenworthy, 1989; Newman and Kenworthy, 1999).

At some point, the market may become saturated with vehicles. Vehicle

ownership per 1,000 people is projected to continue rising in the medium term, suggesting this saturation point is yet to be reached (Cameron, 2004). Using international data, Dargay and Gately (1999) estimated, based on economic modelling, that the saturation point may be 0.85 cars per person. More recent analysis, however, suggests that the saturation point may vary from one country to another, but consistently, vehicle ownership has and will continue to grow alongside increasing income (Dargay, Gately and Sommer, 2007). The implications of this analysis are significant: in developing countries, vehicle fleets are predicted to burgeon. China's automotive fleet, for example, is predicted to reach 390 million by 2030; an increase of nearly 2,000% (Dargay et al., 2007).

Figure 1: Historic and projected vehicle ownership in major Australian cities



Source: Australian Bureau of Statistics (2001), Cameron (2004), Kenworthy and Laube (1999)

Figure 1 combines Kenworthy and Laube's (1999) data with Australian Bureau of Statistics (2001) information and Cameron's (2004) projections for vehicle ownership in five Australian cities. In this graph, the data for 1961, 1971,

1981 and 1991 has been used as a proxy for 1960, 1970, 1980 and 1990 respectively, to ensure consistent time periods across the graph. Based on available data, the 'boom' period for growth in ownership of vehicles occurred

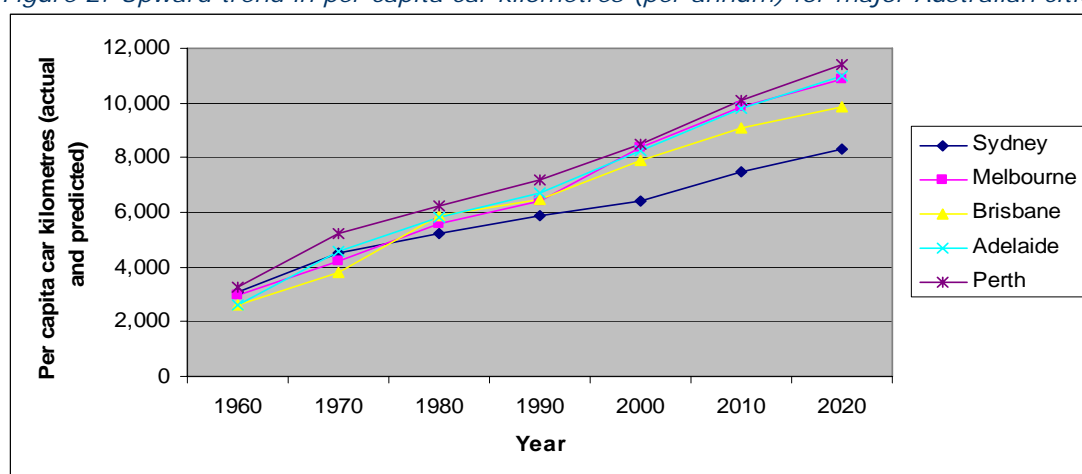
in all cities between 1960 and 1980. Similarly, Kenworthy and Laube (1999) have identified a continual rise in per capita car kilometres (per annum) for major Australian cities, for the period 1961 - 1991. Cameron's (2004) projections for 2010 and 2020 are for further increases. Again, Kenworthy and Laube's data is used as a proxy for 1960, 1970, 1980 and 1990 to ensure consistent time periods with Australian Bureau of Statistics (2001) information for 2000 and Cameron's (2004)

projections. These data are combined in Figure 2.

For Perth, the growth in the ownership and use of private motor vehicles is explained by Cameron and others (2004: p296) in the following way:

[Perth has had] limited if any significant physical planning, transport or economic policy interventions to manage growth in demand for private transport [showing] the extent to which automobile dependence can grow largely unabated

Figure 2: Upward trend in per capita car kilometres (per annum) for major Australian cities



Source: Australian Bureau of Statistics (2001), Cameron (2004), Kenworthy and Laube (1999)

Network creation

Network creation in Australia occurred concurrently with rapid motorisation, vis-à-vis the US experience (Davison, 2004). In 1969, for example, the Victorian state government formulated the Metropolitan Transportation Plan for Melbourne, which promised Au\$1.675b of a \$2.6b transport funding package for a 494 kilometre urban freeway system. The key aim of the Plan was to facilitate commutes between decentralised residential areas and decentralised places of employment. By comparison, public transport only received \$0.355b (Davison, 2004). At the national level, from the 1970s to the

1990s, the Australian Federal government took an important role in the development of roads and interstate highways with the aim to provide more seamless motor vehicle travel; road networks were considered an integral part of national development being the modern transport framework (Newman, 2005). By comparison, it has been suggested that Federal grants for state agencies for public transport projects were given infrequently and were worth significantly less (Scheurer, Kenworthy and Newman, 2005).

The focus on provision of infrastructure for motor vehicles, which makes these trips more convenient, perhaps explains community preference to travel by car rather than by other modes and perhaps to make additional trips. The phenomenon of increasing trip frequency has been facilitated by enhanced infrastructure and is known as induced demand (Buchanan, 1963; Hill, 1996) or induced traffic (Bachels and Newman, 2001). Moreover, international research (including analysis of Australian data) by Cameron and others (2004) into vehicle kilometres of travel from 1960-1990 suggests that increasing affluence is associated with rising urban mobility. As motor vehicles have become more affordable, people have had more opportunities to drive. Consequently, synergisms can be seen between rising car ownership, the affordability of driving and increasing provision of roads.

Policies advocating network creation were vociferously supported by motorists' lobby groups, including the Australian Automobile Association (AAA). From 1945, the AAA lobbied the Federal government on matters of taxation and road financing, State governments to divert transport expenditure from public transport and to monitor road policy, and local governments for more investment in roads (Davison, 2004). Davison argues that rather than being apolitical the AAA has often been affiliated with the national

conservative party (*the Australian conservative party is called the Liberal Party*) and with such a political alliance, has become more active and aggressive over time. The road lobby is argued to continue to exert a powerful influence over transport policy (Laird, 2001).

There continues to be significant Federal investment in infrastructure for motor vehicles but comparatively little in infrastructure for alternative modes (Newman, 2005). Between 1996 and 2000, Au\$8b of Federal funds were invested in road projects; 100 times more than rail (Laird, 2001). In contrast, early this decade, the US was reported to invest about 20% of Federal transport funds in rail and mass transit (Laird, 2001). It is left to State and local governments to find most of the funds for alternative transport projects: a task that seems to be better handled by some governments than others. Recent State expenditure on public transport in Western Australia has been relatively positive. Under the guidance of the current Minister for Planning and Infrastructure, more than Au\$1.6b is being invested in a new 72 kilometer long southern passenger rail line, which is scheduled to be completed in late 2007 and will greatly extend the existing rail system (Australasian Tunneling Society, n.d.). There is presently no rail line servicing Perth's extensive southern suburbs (see Figure 3).

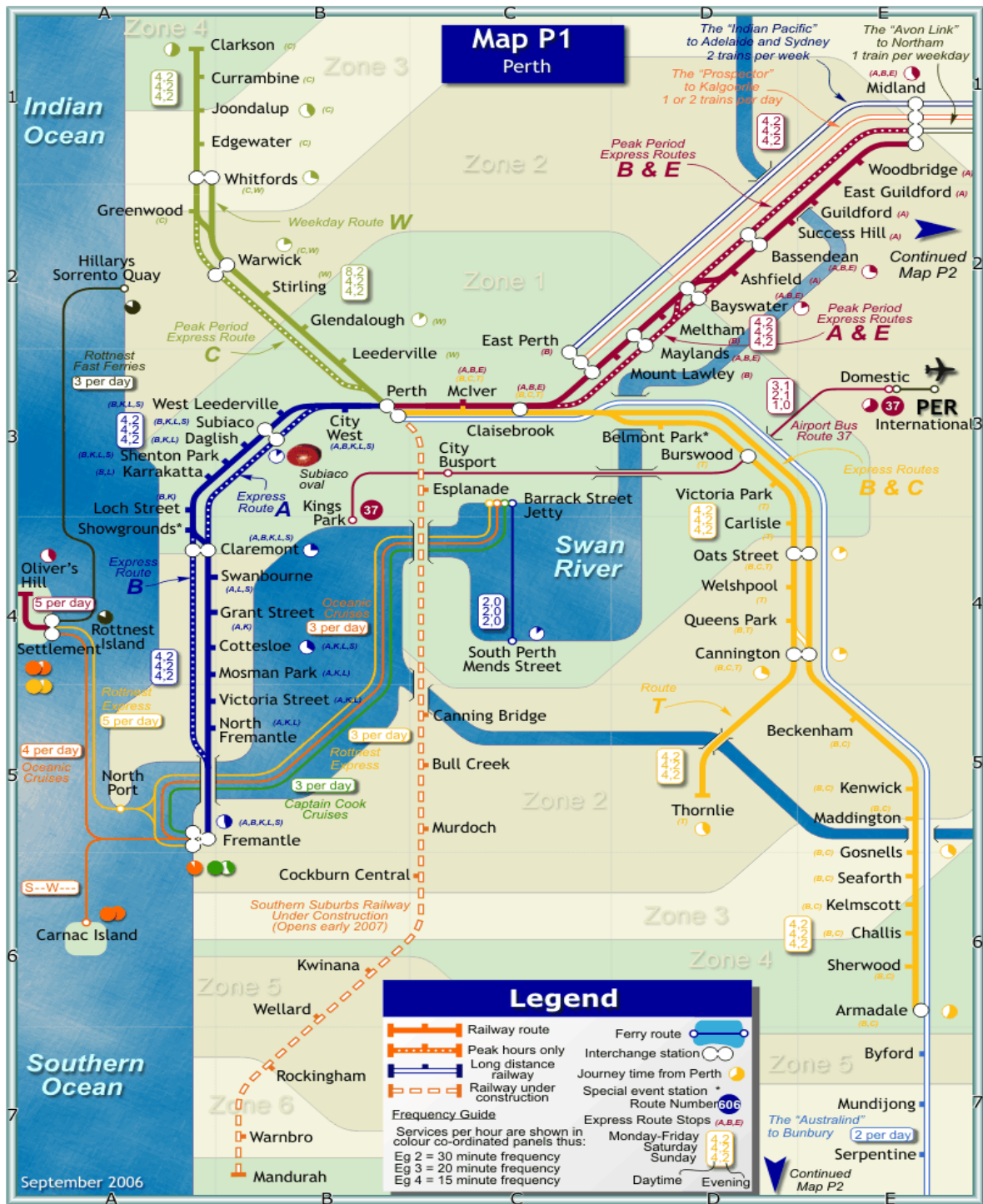


Figure 3 – Perth's new southern rail line

Source: <http://www.railmaps.com.au/perth.htm>, retrieved: 27/06/2007

In addition to the investments in roads, there is an institutional subsidy provided to road users. Laird and Newman (2001b) have calculated this to be AU\$8B per annum, not including the costs of congestion in major cities. With congestion costs included, the subsidy is

estimated to be AU\$19B. Taxpayers, for example, pay for the road system, costs associated with accidents, other health impacts and fund tax relief for vehicle use. The revenue from fuel tax, registration fees and insurance premiums does not nearly cover this expenditure

(Laird and Newman, 2001b). The ongoing imbalance in funding, the subsidy offered to road users and the level of political support for road projects together represent substantial barriers to more balanced Federal transport funding policy and furthering the sustainable transport agenda in local areas.

Parking provision

Parking is equally as important as networks as a determinant of motor vehicle use. Motor vehicles must have somewhere to park both at the beginning and end of journeys. Intuitively, rapid motorisation leads to rapid growth in the demand for parking. In Perth, where there is a high level of car ownership per capita (see Figure 1) there is liberal provision of car parking areas throughout the metropolitan region. Vis-à-vis the US experience, a minimum provision of car parks per building is required in city planning regulations. In addition to minimum requirements, there are both public and privately-run car parking areas provided throughout the city. Mid 1990s, in the central city, there were a reported 630 spaces per 1,000 CBD jobs (Scheurer et al., 2005).

Research conducted on behalf of the Western Australian Planning Commission, the City of Perth and the Government of Western Australia indicates a drop in parking bays per 1,000 CBD jobs from 669.2 in 1993 to 640.2 in 1997 and 608.9 (kerbside and residential parking is not included in these calculations) in 2001 (Praxis Solutions, 2004). In absolute terms, however, parking provision has increased, albeit more slowly than central city employment. In 2006 there were 60,420 parking bays in the CBD registered under the Perth Parking Management Act², of which

42,930 were for long stays or commercial tenants, thereby suiting full-time workers (Wannell, pers. comm., 2007). The level of parking provision in Perth, gauged by CBD parking, is among the highest in the developed world (Kenworthy and Laube, 2001). High relative levels of parking, much of which has a relatively low tariff (use of City of Perth parking starts at around \$4.40 for 10 hours on a weekday, provided the car is parked before 7:30am) provides a great incentive to drive for work purposes.

In the suburbs, there are often significant areas of (free) parking attached to strip shopping and shopping centres. Tariffed parking outside the CBD is rare. Curtis (2005) found that in the Perth metropolitan area, around 5,000 hectares of land is dedicated to parking, whether free or tariffed. While this is a small fraction of the total metropolitan area (in 1995 the Perth metropolitan area was 114,199 hectares in size and has grown since (Kenworthy and Laube, 2001)) it is still a significant real area of land. The provision of so much parking further encourages car trips. Californian research, for example, has found that there is a significant association between parking provision and employee's mode choice (Lund et al., 2004).

Parking, where it is not tariffed may impose no cost on the casual motorist but is not 'free'. Shoup (2004) shows that 'free parking' can have annual indirect costs in the billions of dollars as the areas devoted to parking are not otherwise being used productively. Parking spaces therefore represent badly underutilised land (Newman and Kenworthy, 1999) as are other sealed areas such as service station and car dealership forecourts. Moreover, Toor

and Havlick (2004) undertook economic analysis of car parking provision on University campuses in the US and found that the costs of providing parking include construction costs, maintenance and enforcement as well as opportunity cost. Importantly too, the US Environmental Protection Agency (1998) found that the cost of parking is a significant determinant of travel behaviour: when it is free to the user, its incentive for people to drive.

There are various means to address the land burden associated with parking. A solution is for statutory planning mechanisms to require parking spaces to be provided under buildings, rather than in open space. An even better solution is relaxation of standards that require a minimum number of spaces to be provided, depending on the use of a given property and the other transport options available. Neither of these measures, however, can address the demand for parking, which is linked to car dependence and car preference (Toor & Havlick (2004) discuss parking pricing as a mechanism to discourage driving. The interested reader is encouraged to look at their work for more ideas for combating preferential treatment).

Car culture in Perth

Newman and Kenworthy's (1999) analysis indicates that Perth is one of the most car dependent cities in the world. The Perth population's current reliance on cars for travel is best illustrated by recent data relating to mode use and trip distances. The Western Australian Greenhouse Task Force (2004: p63), for example, reports that:

...every day Perth drivers travel the equivalent distance of 500 times around

the world (more than 20 million [kilometres]) ...in their car.

In 1991, Curtis (2001) reported that 76% of all personal trips made in Perth were by car. In 2001, 80% of all peoples' trips were being made by car, as either driver or passenger (Socialdata Australia, 2001). More recent analysis suggests that there are around 4.8 million trips made per day in the Perth Metropolitan Region, of which 5 out of 6 are made by car, as either driver or passenger (PATREC, 2005).

The historical rise in the ownership and use of cars has contrasted with a decline in the use of public transport. Over the period 1966 to 1995 the percentage share of public transport dropped from 20% to less than 7% (DPI, 1995). However, Scheurer (2005) reports that more recently this decline has been reversed, thanks in part to greater investment in rail. The new southern rail line should further contribute to the reversal. Nevertheless, private motor vehicle travel continues to far outweigh trips by public transport. Data from 2001 suggests that, on average, people make about 803 trips by car per annum, compared with only 159 trips by foot, 65 by public transport and 32 by bicycle (James et al., 2001).

In Perth there appears to be a culture of driving, even for short trips. Perth drivers are reported to make somewhere in the vicinity of 250,000 car trips per day of 1 kilometre or less (Premier's Physical Activity Taskforce, 2006). This means that more than 5% of the 4.8 million daily car trips made in Perth should be easily substitutable for active modes, thereby leading to up to 250,000 fewer vehicle kilometres travelled per day.

Further estimations suggest that 48% of all trips by car cover less than 5 kilometres and 71% cover less than 10 kilometres (Wooldridge, 2005).

Similarly, research has found that 72% of trips to local facilities are made by car while only 21% are made by foot, suggesting potential for mode substitution (DPI, 2000). Some trips require the movement of heavy goods, such as groceries, or goods that are awkward for pedestrians or bicyclists to carry. Motor vehicle would seem to be the most practical mode for these trips. Nevertheless, it may be feasible for half or more of all trips made by car to be made by another mode (Ashton-Graham et al., 2005). This is aside from any reductions in vehicle kilometres travelled or car trips that could be achieved by building more accessible neighbourhoods and people undertaking more local travel for shopping and other personal business.

There is an emerging body of literature investigating the phenomena of choice and preference. This research will answer questions such as why people may choose to drive even when they could quite easily walk, bicycle or use public transport. Societal norms influence individual attitudes and behaviour as do 'official' and professional attitudes and policies (Davies et al., 1997). In the post World War Two period, official land use and transport policy advocated decentralisation and motorisation, and as such the norm has become to use the car for the vast majority of trips, while alternative modes, whether by design or implication, have frequently become far inferior choices. Consequently, for many people car use has become so habitual that driving is now part of North American and Australian culture (Bachels

and Newman, 2001; Falconer, 2004; Falconer and Kingham, 2007; Rees, 2003). Furthermore, people may construe driving to be necessary even when there are other alternatives available (Handy et al., 2005b). There is evidence that people do drive more than they (think they) need to (Handy, 2003; Handy et al., 2005a) and there is likely to be difficulty in trying to change habit (Frank et al., 2004).

Private vehicles are prized assets, not least because of the flexibility they offer in transport decision-making. They are therefore empowering and are often marketed as an essential consumer good for the family (Kenworthy, 1994). They can serve a number of roles other than transport. They can be tools to facilitate other travel preferences (for example, provide access to distant opportunities because they are seen by the individual to be superior to local opportunities), recreate, provide mobile private space, construct identity and signify status (While not the only focus of this study, car culture is likely a significant influence on travel patterns. Cultural geography, for example, is rich with discussion of identity formation and the role of props, including cars, in this task). Motor vehicles can also provide people with recreation opportunities, not simply access to recreation (Handy, 2003; Handy et al., 2005b). In-other-words, they allow driving for the sake of driving, not only to get to anywhere in particular.

Together, these points show that factors that influence high levels of car use are two-fold. First, cities have been designed in such a way as to make cars the only practical choice for many trips (car dependence). Second, car use has become so ingrained in the public psyche

that the private vehicle is the default choice even when there are practical alternatives available (car preference). This begs the question: why is reliance on cars unsustainable?

Why are car dependence and preference unsustainable?

It is important to conceptualise transport sustainability as the sum of many different variables. That is, any appraisal of transport patterns should include analysis of energy consumption, emissions and implications for public health. There are other relevant dimensions of transport sustainability, including social in/equity, but these are not covered in this paper. The point, however, is clear. The sustainability of transport patterns is simply a function of affordability. Accordingly, there is good reason for research into transport sustainability to be inter-disciplinary. In this section we explore how the unprecedented mobility 'enjoyed' by private vehicle owners is of concern given dependence on oil for transport energy, vehicle-based pollution and implications for public health.

The twilight of cheap oil

Currently, the majority of the vehicle fleet depends on oil for fuel. In a general sense, the transport sector relies on sufficient global oil supply to cater for demand. Parker (2005: p66) argues that "Australia has become addicted to cheap oil, especially for transport, which uses almost 80% of Australia's petroleum". Perth residents are no exception: relying heavily on oil for transport energy (Newman et al., 1990). However, there is a growing body of evidence to suggest that the world is facing a global supply problem, the consequences of which will be felt in Australian cities including Perth.

By the late 1990s the majority of the Oil Producing Economic Community (OPEC) had reached peak sustainable output (Simmons, 2005). The bulk of oil supply is sourced from a small number of aging giant and super-giant middle-eastern fields. The portents are not good; no new fields of any significance have been discovered in the last three decades (Simmons, 2005). Even so, in 2003, global demand for oil was 80 million barrels per day and rising 3% per annum (Parker, 2005). Huge growth in the transport sectors of emerging countries such as China contributes to increasing demand as does strategic stockpiling by some countries in anticipation of future price rises and oil shortages. The result will be an increasing imbalance in supply versus demand.

Some researchers have argued that the production peak will be reached by 2020 while demand continues to rise (Campbell, 2003; Campbell and Laherrère, 1998). Fleay (2005) argues that the peak has already been reached. At 2003 rates of consumption, Australia's remaining economic reserves are only sufficient for the next 11 years (Parker, 2005). At the global scale there is little potential for supply to rise to meet burgeoning demand and as such the twilight of cheap oil is upon us (Simmons, 2005). Moreover, it must be understood that new technology, including hybrid (electric/petrol) vehicles is not commonplace. There can be no quick replacement of the petrol-driven vehicle fleet and thus new technology is neither a short nor medium term fix to oil dependence. Consequently, it is expected that the Australian government will be forced to plan for more sustainable travel as the effects of higher fuel costs continue to be felt (see Rural and

Regional Affairs and Transport References Committee, 2006) as will other governments elsewhere.

The final report by the Standing Committee on Rural Affairs and Transport (2007) recognises that while supply-side responses, including boosting local production of oil, synthetic fuels and biofuels may lessen the impacts of peak oil, demand-side responses offer important long-term solutions. These include planning for more sustainable transport behaviour, with emphasis on alternative mode use.

Conventional planning and public health

Active mode use is a great way to be physically active. Physical activity and associated health benefits are incidental to the trip, which is often made for another purpose. Physical activity has been described as perhaps the least costly and easily administered modern urban treatment regime (Rees, 2003). Research shows that adults who are sufficiently (regularly) physically active, reduce by 50% the risk of developing serious chronic illnesses including heart disease, osteoporosis, colon cancer, type II diabetes, and being overweight or obese (Bauman et al., 2002; Davis et al., 2005; National Heart Foundation, 2004; Transportation Research Board, 2005). Regular physical activity is also an important treatment for a range of conditions including type II diabetes, as it contributes to improved glycaemic control and insulin sensitivity (Miller and Dunstan, 2004). Powell and Blair (1994) estimate that in the US, between 32-35% of deaths related to coronary heart disease, diabetes and colon cancer are preventable if people were to sufficiently increase their physical activity.

Moreover, a review by Hartman-Stein and Potkanowicz (2003) underlines the benefits of regular physical activity in delaying the onset of age-related health problems.

Conversely, insufficient physical activity is associated with a variety of chronic diseases including type II diabetes, overweight/obesity, mental ill-health and cardiovascular diseases (Frumkin et al., 2004; Lee and Paffenberger, 2000; National Heart Foundation, 2004). In Australia, the proportion of people classified as overweight or obese is rising alarmingly. In 1999, 20% of persons aged 25 or older were categorised as obese (Australian Institute of Health and Welfare, 2001). More recent data suggests nearly 60% of adults and 25% of children are overweight or obese (Australasian Society for the Study of Obesity, 2005). The annual cost of health services to treat conditions associated with inactivity has been estimated to be almost Au\$380m (Stephenson et al., 2000). However, a recent Access Economics report estimated that obesity already cost the country Au\$3.76b annually in lost productivity, carer costs and costs borne by the health system (Access Economics, 2006).

For more than a decade it has been recognised that regular brisk walking in lieu of more vigorous forms of exercise can reduce health risk factors (Pedestrian Council of Australia, 2006; Ploeger, 2003; Sallis et al., 2004). Walking is exercise that is accessible to all members of the public, assuming they do not have mobility impairments. It costs nothing to do and as such, it is little wonder it is the predominant form of physical activity for those on lower incomes (Fenton, 2003; Morris and Hardman, 1997; Siegel et al.,

1995). For society, walking can reduce healthcare costs (Cao et al., 2006) and when it is the substitute for a car trip it can have benefits for the environment. From a health perspective, bicycling may be even better, as it requires the use of major muscle groups, can elevate a person's heart rate to a level that is of cardiovascular benefit and can expend a high number of calories (Cavill, 2003; Woolridge, 2005). Moreover, bicycling is a more realistic mode choice for many journeys because it enables people to travel further than if they were to walk.

It is argued that sprawl and car dependence can contribute to physical inactivity, with related health implications. This is because residents of sprawled, car dependent areas tend to have less opportunity to use active modes to complete utilitarian trips (see Wright, 2003). Vandegrift and Yoked (2004), for example, point to an association between rising rates of obesity in North America and widespread suburban sprawl. Gee and Takeuchi (2004) and Hillman (1997) argue that car dependence is contributing to rising obesity and stress levels, and detrimentally affects mental health. Car dependence and sprawl therefore pose significant challenges for facilitating and increasing active mode use (Hu and Young, 1999).

In addition to being a sedentary mode, private motor vehicles are now understood to be significant contributors

to urban air pollution (Cavill, 2003; World Health Organisation, 2003). In contrast public transport generally produces much less airborne pollution per capita (Kenworthy, 2003) while active modes produce none at all. Vehicle kilometres of travel (VKT) can be used as a surrogate for vehicle emissions (Lyons et al., 2003). Figure 2 illustrates how VKT is continuing to rise in many of Australia's major cities. With people using their cars to conduct more of their life's work and driving greater distances overall, it follows that more pollution is being produced, per head of population. All else being equal, when rising VKT is considered alongside increasing urban area and rapid urban population growth, the data show that while there may not necessarily be large increases in the density of pollution, there are definitely higher real levels of pollution over a larger area (see Table 1).

The volume of pollution produced by each individual vehicle does depend on a number of intermediary factors. From 1986 to 1996, Perth's vehicle fleet improved in performance with grams of carbon monoxide (24.55 to 19.17) and hydrocarbons (2.36 to 1.55) emitted per kilometre of travel having fallen and oxides of nitrogen having remained fairly static (2.33 to 2.29) (Cameron, 2004; Western Australian Department of Transport, 1995). These performance improvements, however, are counter-balanced by rising VKT (Cameron, 2004).

Table 1: Perth's growing urban area compared to rising VKT and urban population

Year	1980	1990	2000	2010 (projected)	2020 (projected)
Urban area (km ²)	835.5	1,074.6	1,316.0	1,480.0	1,590.0
VKT (per capita per annum)	6,250	7,203	8,472	10,071	11,409
Population	898,918	1,142,646	1,381,127	1,644,300	1,903,900

Source: Australian Bureau of Statistics (2001), Cameron (2004), Kenworthy and Laube (1999)

Furthermore, European research has found that emissions vary as a function of traffic speed (André and Hammarström, 2000). Analysis shows that at very slow speeds (around 20 kilometres per hour or less) and to a lesser extent, at high speeds (around 100 or more kilometres per hour) emissions (of carbon monoxide, hydrocarbons and oxides or nitrogen) trend upwards (Cameron, 2004; Department of the Environment, Transport and Regions, 1995; Kenworthy and Laube, 2001). It therefore follows that in congested areas or where vehicles otherwise have to travel slowly or idle, more pollution is produced.

It is clear that ambient air pollution varies as a function of space. To illustrate, particulate matter (PM), especially ultra-fine particles (<PM_{2.5}) tend to accumulate at traffic lights, where large numbers of vehicles idle waiting for the lights to change. Masses of ultra-fine particles are very sensitive to local traffic conditions, whereas masses of larger PM (e.g. PM₁₀) are generally more reflective of local background concentrations (Harrison, Jones and Collins, 1999). Generally, more emissions and hence more airborne pollution will be found near to major arteries/freeways, which not only can become congested at times but also tend to be heavily trafficked (Riedliker et al.,

2003). Dutch research found that people who live near busy roads were exposed to significantly higher levels of a variety of pollutants, including PM, carbon monoxide and nitrogen oxide than those who do not (Roemer and van Wijnen, 2001). Similarly, a study in Los Angeles found an inverse relationship between levels of PM and proximity to a major transport artery, which held true to a distance of about 300 metres (Zhu et al., 2002).

A person's level of exposure to pollutants also relates to the mode of transport they use. Elsom (1996) argues that car drivers and their passengers may inhale as much as 18 times more pollution while inside their vehicles than those outside. Dickens (2000) has found similarly. Interestingly, data from Copenhagen shows that car drivers are more exposed to air pollution than bicyclists who might likewise be negotiating busy streets (Rank et al., 2001). This is surprising, as bicyclists typically have a higher respiration rate, given the strenuous exercise they are engaging in. Bicyclists, however, do not often find themselves in the middle of the traffic flow and pollutants can accumulate in the cabins of motor vehicles.

Given these understandings, urban air quality may be considered a function of motor vehicle usage per unit area,

contingent on the characteristics of the vehicles and the speeds at which they are being driven (Cameron et al., 2004). However, it should not be overlooked that whilst the city, urban population and VKT per capita grow, air quality is being diminished over an increasing area.

From a public health perspective, exposure to pollution is of concern. Many researchers have identified associations between air pollution and adverse health, including respiratory illness (Brunekreef, 1997; Cohen, 2000; Katsonyanni and Pershagen, 1997; Oosterlee et al., 1996; Ontario College of Family Physicians, 2005; Sallis et al., 2004). Persons who are consistently exposed to high levels of particulate matter (PM), especially ultra-fine particles, may suffer constant respiratory distress and have their life expectancy reduced by one to two years (Brunekreef, 1997; Dominici et al., 2003). Pope (2000) argues that there is no 'safe' level of exposure to PM. Any exposure does harm. Links have been found between pollutants including PM and increased mortality rates (Revkin, 2001). In Great Britain for example, recent conducted during the late 1990s found that PM is linked to 8,100 premature deaths per annum (Acheson, 1998). Furthermore, pregnant women who are exposed to air pollution have an increased risk of there being adverse effects on the development of their foetus (Ritz et al., 2002). In Australia, there is increasing interest in air pollution and its health effects, given accumulating evidence of a casual link and recognition that vehicle emissions are a major contributor (Kjellstrom, Neller and Simpson, 2002). Water pollution is also associated with sprawl and car dependence. Tyre attrition leaves rubber on the bitumen, pollutants

drip from exhaust-pipes and other materials can come from the body of vehicles (Gillham, 2002; Shore, 2006). These contaminants remain on roads, parking areas and forecourts, until water (often from rainfall) transports the contaminants into drains, gutters or standing pools on the verges of roads and other sealed areas. Run-off often ends up in the storm and waste-water systems of the city, thus being integrated into the hydrological cycle (Brabec et al., 2002). Given fluids are often channelled into specific 'waste water' systems, sudden torrential rainfall can overwhelm the urban storm and waste-water arrangements (Steiner, 1978). While pollutants entering the hydrological cycle are of concern, it is when 'storm surges' inundate roads, infiltrate into clean water supplies and thereby create public health hazards that are particularly problematic.

Furthermore, vehicles are sources of noise and vibration (Steiner, 1978). Intuitively, continued exposure to traffic noise is likely to affect people's wellbeing. Nevertheless, health experts continue to disagree as to the effects of incessant traffic noise on people's mental health (Mason, 2000; World Conference on Transport Research Society and Institute for Transport Policy Studies, 2004). It is difficult to identify how people are affected by transport noise, relative to how close to roadways they live, while controlling for in-home noise attenuation. Noise pollution can also have varying effects depending on people's routines. People may be differentially affected while they are working, for example, compared with when they are trying to sleep. There is recognition, however, that traffic noise has acute effects on people while they

are walking or bicycling (Whitelegg, 1993).

In addition, conventional transport infrastructure tends to be a highly visible component of the urban fabric. In many cases, roads and the vehicles that use them are sources of visual pollution (Steiner, 1978). Emissions from vehicles contribute to smog, which too is a form of visual pollution. This form of pollution is increasingly being recognised as a by-product of urban activity, particularly transport (O'Riordan, 1995). Beatley (2004) argues that the liveability of places is seriously denuded by the sterility of freeways, highways and other roads. They are corridors for vehicle movement and little else. As has previously been discussed, the more sprawled and car dependent cities are the more green-space tends to be covered with these and other impervious, sterile surfaces.

Using reform strategies to tackle car dependence and car preference

Together, the sustainability issues that have been discussed point to two significant issues facing planners and policy makers. If it is accepted that sprawl and high levels of private motor vehicle use are unsustainable, how then might a reform agenda deal with both car dependence and car preference? In Perth, Western Australia, some key land use and transport reform strategies have recently been implemented to tackle these problems. These include Liveable Neighbourhoods and Travel Smart. These strategies have been developed with the understanding that strong policy can exert control on urban growth and mobility: policy that has perhaps been lacking in Perth (Cameron et al., 2004).

Land use planning reform:

Liveable Neighbourhoods

It is commonly accepted that land use and transport systems are inseparable. Physical changes to urban form, such as development of new neighbourhoods affect transport systems and vice versa. Many researchers acknowledge this association but remain undecided about the exact influence of the built environment on travel patterns (Crane, 2000; Ewing and Cervero 2001; Frank, 2000; Newman and Kenworthy, 1999; Saelens et al., 2003; Sallis et al., 2004). One of the great challenges to there being any sort of casual relationship established between the built environment and travel behaviour is self-selection. It is assumed that some people will choose to live in neighbourhoods where there are relatively more opportunities to walk, bicycle and use public transport. Nevertheless, researchers remain unsure as to the significance of self-selection.

Even so, land use planning is often seen as one mechanism to improve transport sustainability. It may be considered a 'hard', or structural change mechanism to provide people with more opportunities to walk, bicycle or public transport, through improving access to the facilities people need to conduct their life's work. This renders car travel less necessary. The literature is rich with research that has investigated how access may be better provided. Mixing of land uses, increasing development densities and improving street network permeability are frequently found to be associated with opportunities for more sustainable transport behaviour (Cervero and Radisch, 1996; Frumkin et al., 2004; Naess, 2005; Newman and Kenworthy, 1989; Newman and Kenworthy, 1999;

Van and Senior, 2000). Importantly, too, urban development can be a lasting population-level intervention, assuming it is back by strong statutory planning requirements. That is, if planning codes require a certain minimum of access, then access can be improved anywhere there is (re)development.

These opportunities for regional increases in transport sustainability have informed the “Liveable Neighbourhoods” (LN) planning suite, which has been developed by the Department for Planning and Infrastructure (DPI) and Western Australian Planning Commission (WAPC). The Western Australian Greenhouse Task Force (2004: p65) reports that LN is:

...a voluntary planning design code that promotes the development of sustainable communities with mixed land use and a balanced transport system. It encourages reduced car usage, better use of public transport, more walking and cycling, improved access to services and more efficient land use

LN has been developed as a context-specific planning approach, but even so, it has links to a number of other sustainable development approaches including New Urbanism, Transit-Oriented Development and Smart Growth. It is also reflective of a wider paradigmatic shift towards more sustainable urban planning in Australia (Taylor Burrell Barnett, 2004). The code has been on trial since February 1998 and is now in its third edition. Developers can voluntarily accept it over the conventional code, so it therefore an optional set of standards (The voluntary nature of the code may be a significant challenge to it being a useful part of the

sustainability agenda. Future research should examine this in more detail.

Early analysis of neighbourhoods developed after LN became operational indicates that the take-up rate of the code remains relatively low and that developers are tending to pick and choose criteria according to their own agendas.

The design code was developed by the DPI through a process of retooling the Australian Model Code for Residential Development 1995 to facilitate a better fit for the West Australian context. State planning authorities recognised the need to address issues associated with conventional planning practice, especially rapid fringe development. Such issues include the high cost of providing services and facilities, including utilities to outlying developments, a lack of local employment opportunities, relatively poor public transport provision, car dependence, and questionable social, economic and environmental sustainability.

The purpose of LN is for it to be a performance-based vehicle to meet the objectives of the State Planning Strategy. It is intended to facilitate the development of more sustainable communities, as part of the vision for Western Australia 2029. Some of the key outcomes envisaged for LNs are increased support for active modes and public transport, higher development densities and increased lot diversity. Development is to be focused round activity centres and public transport nodes (WAPC, 2004). The design code is to be applied to development proposals on greenfield (It is significant to note that the code anticipates greenfields development and does not require at

least a minimum of infill) sites encompassing two or more lots and larger infill sites (WAPC, 2004). The key for LNs is for them to be relatively self-contained. Its particular strengths are suggested to be that it is contextual, practical and facilitative (Taylor Burrell Barnett, 2004). Moreover, the code is a regulatory tool, not simply an advisory document and it can be applied at a variety of scales. It assumes coordination of new development, insofar as new neighbourhoods should be incorporated into towns, which in turn are part of the regional infrastructure. With it still being in the early stages of implementation, it is of interest to see if the code is producing communities as is intended. Current research aims to conduct such analyses (Falconer et al., 2006; Giles-Corti et al., 2006).

Behavioural reform: Travel Smart

As useful as LN may be for lessening dependence on cars, it cannot tackle car preference. The State government has implemented a behavioural change strategy called Travel Smart to help deal with this. Travel Smart aims to achieve improved mode share targets by empowering people to make use of alternative modes and reconsider discretionary trips. It is a means to educate people about the alternative transport opportunities available to them. Generally speaking, educational and social marketing strategies are a means to make people more mindful of the trips they make and how they make them. They can be effective at changing habitual behaviour, which is borne out of choice rather than necessity (Bamberg et al., 2003; Garling and Axhausen, 2003).

The first step in the Travel Smart programme is to select a study sample,

with it being important that the study area is well provided with options for alternative travel. Those who agree to participate in the programme are administered a travel diary, which they complete and return. After the diary is analysed, a trained operator conducts an interview with the participant. The participants receive personalised feedback about their travel behaviour including suggestions about how certain trips could be made without use of a private vehicle. It is a labour-intensive strategy that aims to add to people's knowledge about alternative modes, routes and opportunities (James and Brög, 2003).

Results show some success. IndiMark, or Individualised Travel Marketing (the report presented to participants) has been applied to 35,000 persons in South Perth. Results indicate that the programme has reduced the relative number of car trips by 14% amongst participants, while increasing walking trips by 35% and bicycling trips by 61% (James and Brög, 2003). The administration of Travel Smart in greater Perth has yielded a 10% reduction in car trips amongst participants, with 80% of behavioural changes having been sustained for 4 years (Ashton-Graham et al., 2005).

Naess (2005) notes that the routine nature of many trips suggests people do not often reflect upon them. Behavioural change strategies such as Travel Smart can be useful because they empower people to critically reflect upon their travel. Intuitively, they can then consider, with the aid of individualised marketing material, more sustainable ways of fulfilling their travel wants and needs. These strategies can be cost-

effective when considered alongside infrastructural changes. However, they rely on the public being amiable to change. While James and Brög (2003) note that post-programme surveys show that behaviour change can be enduring, it is unclear how successful the strategy will be for producing sustainable transport outcomes in the long term.

In general, behaviour change strategies must both furnish participants with compelling reasons to change their attitudes and then sustain them through various stages of follow-up. This is important, as attitudes towards travel can be strengthened by habit (Forward, 2003). Researchers note the incredible difficulty of achieving any behaviour change, especially sustained change given car culture and car dependence in many cities (Sallis and Owen, 1999; WCTRS and ITPS, 2004). Moreover, a city that is unfriendly towards active mode users and users of public transport is a difficult context within which to 'sell' a sustained behavioural shift away from private vehicle usage. For these reasons, despite the positive results associated with Travel Smart, it can be seen that it and LN are really interdependent initiatives.

This analysis of LN and Travel Smart shows how general policy approaches can be synthesised from international research findings then tailored to context. The general principles of LN, for example, are shared with the widely recognised Smart Growth and New Urbanism strategies in as much as higher quality, more activity-intensive communities are anticipated, linked together by efficient public transport. This demonstrates how the theoretical underpinnings of reform agendas can be

transferred from one context to another then applied depending on local conditions, such as the state of urban systems. Just as there have been unintended consequences arising from conventional planning, such as public health concerns, so might there be consequences of the reform agenda. As such, it is now important that as strategies such as LN and Travel Smart are increasingly applied, that they are evaluated. This will ensure that they are being implemented as intended and where there are deficiencies research can be informative about how improvements might be made.

Summary

This paper has discussed the growth of Australian cities throughout the latter half of the 20th Century. With specific reference to Perth, it has been examined how innovations in the housing market, land use planning and rapid motorisation have contributed to the sprawled, car dependent urban forms of today. Significantly, many Australian cities including Perth owe much to the practice of modelling growth on the North American experience.

Car dependence and sprawl have been shown to pose many challenges to sustainability. Some of the more significant include fossil fuel dependency, the public health impacts of diminished physical activity (in part, as a consequence of less active mode use) and various forms of pollution. Given these challenges and others, in Perth, Western Australia the State Government has responded by implementing the "Liveable Neighbourhoods" design code, which is a specific measure that aims to reduce car dependence. Significantly, it anticipates that new neighbourhoods will

be more self-sufficient; people will have greater access to local facilities and will have more opportunity to walk or bicycle for transport. They will also include better access to public transport. While LN has great potential to reduce car dependence through these provisions, it is not a mechanism to reduce car preference. However, Travel Smart has been developed as an individualised behavioural change mechanism and is a compliment to LN. Early analysis of Travel Smart indicates that it is having some lasting effects on people's travel behaviour and is therefore contributing to transport sustainability.

The importance of this research is that it sets a backdrop against which recent state planning and behavioural change strategies have been developed. Furthermore, it provides context for future assessment of the transport sustainability agenda: existing research projects, including RESIDE are analysing how LN is being applied. This paper should add to understandings of the theoretical underpinnings of reform agendas can be transferable, but how tailoring specific policy to context is vitally important.

References

- Access Economics, 2006. The Economic Costs of Obesity. Report by Access Economics Pty Limited to Diabetes Australia, October, 118pp [Retrieved: 8/11/2006]
<http://www.accesseconomics.com.au/publicationsreports/showreport.php?id=102>
- Acheson D., 1998. Independent Inquiry into Inequalities in Health. London: Stationery Office
- André M., Hammarström U., 2000. Driving speeds in Europe for pollutant emission estimation. *Transportation Research Part D* 5, 321-335
- Ashton-Graham C., John G., Radford T., Rampellini P., 2005. TravelSmart + TOD = Sustainability and Synergy. Paper presented at the Transit Oriented Development (TOD) conference 'Making It Happen', 6-8 July, Fremantle, Western Australia
- Australasian Society for the Study of Obesity, 2005. Fast Facts. June [Retrieved: 03/07/2007]
<http://www.asso.org.au/home/quicklinks/fastfacts>
- Australian Bureau of Statistics, 2001. Motor Vehicle Census. Canberra: ABS publication 9309.0
- Australian Institute of Health and Welfare, 2001. Heart, Stroke and Vascular Diseases – Australian Facts 2001. AIHW [Retrieved: 13/06/2005]
<http://www.aihw.gov.au/publications/cvd/h5vd01/>
- Australasian Tunnelling Society, undated. The New Metro Rail City Project, Perth. [Retrieved: 27/06/2007]
<http://www.ats.org.au/wmview.php?ArtID=51>
- Bachels M., Newman P., 2001. Cities back on track: using a systems approach for sustainable city policy. In: Laird P., Newman P., Bachels M., Kenworthy J., (Eds), Back on Track: rethinking transport policy in Australia and New Zealand. Sydney: UNSW Press, pp. 133-155

- Bamberg S., Rolfe D., Weber C., 2003. Does habitual car use not lead to more resistance to change of travel mode? *Transportation* 30, 97-108
- Bauman A., Bellew B., Vita P., Brown W., Owen N., 2002. Getting Australia Active: towards better practice for the promotion of physical activity. Melbourne: National Public Health Partnership
- Beatley T., 2004. Native to Nowhere: sustaining home and community in a global age. Washington DC: Island Press
- Brabec E., Schulte S., Richards P., 2002. Impervious surfaces and water quality: a review of current literature and its implications for watershed planning. *Journal of Planning Literature* 16, 499-514
- Brunekreef B., 1997. Air pollution and life expectancy: is there a relation? *Occupational and Environmental Medicine* 54(11), 781-784
- Buchanan C., 1963. Traffic in Towns: a study of the long term problems of traffic in urban areas. Reports of the Steering and Walking Groups to the Minister of Transport, London: HMSO
- Cameron I., 2004. Understanding, Modelling and Predicting Transport Mobility in Urban Environments. Thesis presented for the degree of Doctor of Philosophy, Murdoch University, Western Australia
- Cameron I., Lyons T., Kenworthy J., 2004. Trends in vehicle kilometres of travel in world cities, 1960-1990: underlying drivers and policy responses. *Transport Policy* 11, 287-298
- Campbell C., 2003. The Essence of Oil and Gas Depletion. Essex: Multi-Science Publishing Ltd.
- Campbell C., Laherrère J., 1998. The end of cheap oil. *Scientific American March*, pp78-83
- Cao X., Handy S., Mokhtarian P., 2006. The influences of the built environment and residential self-selection on pedestrian behaviour: evidence from Austin, TX. *Transportation* 33, 1-20
- Cavill N., 2003. The potential of non-motorised transport for promoting health. In: Tolley R., (Ed), Sustainable Transport: planning for walking and cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 144-158
- Cervero R., Radisch C., 1996. Travel choices in pedestrian versus automobile orientated neighbourhoods. *Transport Policy* 3, 127-141
- Cohen A., 2000. Outdoor air pollution and lung cancer. *Environmental Health Perspectives* 108(suppl. 4), 743-750
- Crane R., 2000. The influence of urban form on travel: an interpretive review. *Journal of Planning Literature* 15(1), 3-23
- Curtis C., 2001. Future Perth: transport. Perth: Western Australia Planning Commission
- Curtis C., 2005. Creating liveable streets: developing traffic management guidelines for Western Australia. In: Williams K., (Ed), Spatial Planning, Urban Form and Sustainable Transport. Aldershot, England: Ashgate, pp 183-202

- Dargay J., Gately D., 1999. Income's effect on car and vehicle ownership, worldwide: 1960-2015. *Transportation Research Part A* 33, 101-138
- Dargay J., Gately D., Sommer M., 2007. Vehicle Ownership and Income Growth, Worldwide: 1960-2030. January [Retrieved: 28/06/2007] http://www.econ.nyu.edu/dept/courses/gately/DGS_Vehicle%20Ownership_2007.pdf
- Davies D., Halliday M., Mayes M., Popcock R., 1997. Attitudes to Cycling: a quantitative study and conceptual framework. TRL Report 266, Crowthorne, Berkshire: Transport Research Laboratory
- Davis A., Cavill N., Rutter H., Crombie H., 2005. Making the Case: improving health through transport. London: Health Development Agency
- Davison G., 2004. Car Wars: how the car won our hearts and conquered our cities. Crows Nest, NSW: Allen & Unwin
- Department for Planning and Infrastructure, 1995. Perth Metropolitan Transport Strategy 1995-2029. DPI [Retrieved: 14/06/2005] <http://www.dpi.wa.gov.au/publications/metropdfs/mts.pdf>
- Department for Planning and Infrastructure, 2000. Perth Walking: the metropolitan region pedestrian strategy. Perth: DPI [Retrieved: 12/12/2005] available <http://www.dpi.wa.gov.au/walking/1541.asp>
- Department of the Environment, Transport and Regions, 1995. Transport Statistics. Emission Factors for Petrol Cars. DETR factsheet, 1p
- Dickens C., 2000. In-car Particle Exposure. Report prepared for the Department of the Environment Transport and the Regions, May 2000, 47pp [Retrieved: 22/02/2006] <http://www.aeat.co.uk/vpec/projects/incabin/detr-ic-r23.pdf>
- Dominici F., McDermott A, Zeger S., Samet J., 2003. Airborne particulate matter and mortality: timescale effects in 4 US cities. *American Journal of Epidemiology* 157(12), 1055-1065
- Elsom D., 1996. Smog Alert: managing urban air quality. London: Earthscan Publications Ltd.
- Ewing R., Cervero R., 2001. The influence of land use on travel behaviour. *Transportation Research, Policy and Practice* 33, 823-845
- Falconer R., 2004. Boy Racer, an Ambiguous Label: working towards a better understanding and new managerial strategy. Thesis submitted in fulfilment of the requirements for the degree of Master of Science, University of Canterbury
- Falconer R., Kenworthy J., Giles-Corti B., 2006. Model Suburbs? Investigating transport, health and quality outcomes in Perth/Peel's 'liveable neighbourhoods'. Paper presented at the Planning and Transport Research Centre (PATREC) Forum, Perth, 19 September 2006
- Fenton M., (2003) Promoting walking in the US: overcoming the 'stickiness' problem. In: Tolley R. (Ed), Sustainable Transport: planning for walking and

- cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 550-563
- Fleay B., 1995. *The Decline of the Age of Oil*. Sydney: Pluto Press
- Forward S., 2003. Attitudes to walking and cycling. In: Tolley R., (Ed), *Sustainable Transport: planning for walking and cycling in urban environments*. Abington, Cambridge: Woodhead Publishing Ltd., pp 210-223
- Frank L., 2000. How Land Use and Transportation Systems Impact Public Health: a literature review of the relationship between physical activity and built form. Atlanta: Centers for Disease Control and Prevention
- Frank L., Andresen M., Schmid T., 2004. Obesity relationships with community design, physical activity and time spent in cars. *American Journal of Preventative Medicine* 27(2), 87-96
- Frumkin H., Frank L., Jackson R., 2004. *Urban Sprawl and Public Health: designing, planning and building for healthy communities*. Washington DC: Island Press
- Garling T., Axhausen K., 2003. Introduction: habitual travel choice. *Transportation* 30, 1-11
- Gee G., Takeuchi D., 2004. Traffic stress, vehicular burden and well-being: a multi-level analysis. *Social Science and Medicine* 59, 405-414
- Giles-Corti B., Temperio A., Cutt H., Pikora T., Bull F., Knuiman M., Bulsara M., van Niel K., Shilton T., 2006. Development of a reliable measure of walking within and outside the local neighborhood: RESIDE's neighborhood physical activity questionnaire. *Preventive Medicine* 42(1), 455-459
- Gillham O., 2002. *The Limitless City: a primer on the urban sprawl debate*. Washington DC: Island Press
- Gleeson B., 2006. *Australian Heartlands: making space for hope in the suburbs*. Crows Nest, NSW: Allen & Unwin
- Handy S., 2003. Driving less. *Access* 23, 20-25
- Handy S., Cao X., Mokhtarian P., 2005a. Correlation or causality between the built environment and travel behaviour? Evidence from Northern California. *Transportation Research Part D* 10, 427-444
- Handy S., Weston L., Mokhtarian P., 2005b. Driving by choice or necessity? *Transportation Research Part A* 39, 183-203
- Harrison R., Jones M., Collins G., 1999. Measurements of the physical properties of particles in the urban atmosphere. *Atmospheric Environment* 33, 309-321
- Hartman-Stein P., Potkanowicz E., 2003. Behavioural determinants of healthy aging: good news for the baby boomer generation. *Online Journal of Issues in Nursing* 8(2), manuscript 5 [Retrieved: 24/08/2005] http://www.nursingworld.org/ojin/topic21/tpc21_5.htm
- Hill P., 1996. What is induced traffic? *Transportation* 23(1), 5-16
- Hillman M., 1997. Health promotion: the potential of non-motorised transport. In: Fletcher T., McMichael A., (Eds), *Health*

at the Crossroads: transport policy and human health. London: Wiley, pp 177-186

Hu P., Young J., 1999. Summary of Travel Trends: 1995 nationwide personal transportation survey. Prepared for US Department of Transportation, Federal Highway Administration, Knoxville: Oak Ridge National Laboratory

Ingram G., Liu Z., 1999. Determinants of Motorization and Road Provision. World Bank Policy Research Working Paper No. 2042, January

Jacobson M., 2007. Effects of ethanol (E85) versus gasoline vehicles on cancer and mortality in the United States. *Environmental Science and Technology* 41(11), 4150 -4157

James B., Brög W., 2003. TravelSmart/Individualised Marketing in Perth. In: Tolley R., (Ed), Sustainable Transport: planning for walking and cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 384-401

James B., John G., McKaskill J., 2001. Potential for Increasing Walking Trips. Paper presented at the International Walking conference 'Walking in the 21st Century', 20-22 February, Perth, Western Australia

Jones E., 2003. Walkable towns: the liveable neighbourhood strategy. In: Tolley R., (Ed), Sustainable Transport: planning for walking and cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 314-325

Katsonyanni K., Pershagen G., 1997. Ambient air pollution exposure and

cancer. *Cancer Causes and Control* 8(3), 284-291

Kenworthy J., 1994. Better Cities for Families: an international review of urban planning, urban design and transport strategies for more liveable cities. Keynote address to the Cities and Families Conference, November 7-8 1994, The Regent of Melbourne Hotel, Melbourne

Kenworthy J., 2003. Transport energy use and greenhouse gases in urban passenger transport systems: a study of 84 global cities. Paper presented at the International Third Conference of The Regional Government Network for Sustainable Development, 17-19 September, Fremantle, Western Australia [Retrieved: 07/03/2006] <http://www.sustainability.dpc.wa.gov.au/conferences/refereed%20papers/Kenworthy,J%20-%20paper.pdf>

Kenworthy J., Laube F., 1999. An International Sourcebook of Automobile Dependence in Cities 1960-1990. Boulder, Colorado: University Press of Colorado

Kenworthy J., Laube F., 2001. Millennium Cities Database for Sustainable Transport. Brussels: International Union (Association) for Public Transport (UITP), CD-ROM database

Kjellstrom T., Neller A., Simpson R., 2002. Air pollution and its health impacts: the changing panorama. *Medical Journal of Australia* 177(11/12), 604-608

Laird P., 2001. The political problem: the road lobby. In: Laird P., Newman P., Bachels M., Kenworthy J., (Eds), Back on

- Track: rethinking transport policy in Australia and New Zealand. Sydney: UNSW Press, pp 117-132
- Laird P., Newman P., 2001a. How we got here: the role of transport in the development of Australia and New Zealand. In: Laird P., Newman P., Bachels M., Kenworthy J., (Eds), Back on Track: rethinking transport policy in Australia and New Zealand. Sydney: UNSW Press, pp 1-21
- Laird P., Newman P., 2001b. Why it can't go on: the road deficit. In: Laird P., Newman P., Bachels M., Kenworthy J., (Eds), Back on Track: rethinking transport policy in Australia and New Zealand. Sydney: UNSW Press, pp 68-90
- Lee I., Paffenberger Jnr. R., 2000. Associations of light, moderate and vigorous intensity physical activity with longevity. The Harvard Alumni health study. *Journal of Epidemiology* 151, 293-299
- Lund H., 2002. Pedestrian environments and sense of community. *Journal of Planning, Education and Research* 21, 301-312
- Lyons T., Kenworthy J., Moy C., Dos Santos F., 2003. An international urban air pollution model for the transportation sector. *Transportation Research D* 8, 159-167
- Mason C., 2000. Transport and health: en route to a healthier Australia. *Medical Journal of Australia* 172, 230-232
- Metropolitan Regional Scheme 1963. Homepage [Retrieved: 05/10/2005] <http://www.wapc.wa.gov.au/Region+schemes/default.aspx>
- Miller Y., Dunstan D., 2004. The effectiveness of physical activity and interventions for the treatment of overweight and obesity and type 2 diabetes. *Journal of Science and Medicine in Sport* 7(1) suppl., 52-59
- Morris J., Hardman A., 1997. Walking to health. *Sports Medicine* 23(5), 306-332
- Naess P., 2005. Residential location affects travel behaviour – but how and why? The case of Copenhagen metropolitan area. *Progress in Planning* 63, 167-257
- National Heart Foundation of Australia, 2004. Healthy by Design: a planner's guide to environments for active living. June, Victoria: NHFA, 38pp
- Newman P., 2005. Transit Oriented Development: an Australian overview. Paper presented at the Transit Oriented Development (TOD) conference 'Making It Happen', 6-8 July, Fremantle, Western Australia
- Newman P., Kenworthy J., 1989. Cities and Automobile Dependence: an international source-book. Aldershot, England: Gower
- Newman P., Kenworthy J., 1999. Sustainability and Cities: overcoming automobile dependence. Washington DC: Island Press
- Newman P., Kenworthy J., Lyons T., 1990. Transport Energy Conservation Policies for Australian Cities. Strategies for Reducing Automobile Dependence. Perth: ISTP, Murdoch University
- Ontario College of Family Physicians, 2005. The Health Impacts of Urban

- Sprawl: air pollution. Toronto [Retrieved: 16/01/2006]
<http://www.ocfp.on.ca/English/OCFP/UrbanSprawl/default.asp?s=1>
- Oosterlee A., Drijver M., Lebet E., Brunekreef B., 1996. Chronic respiratory symptoms in children and adults living along streets with high traffic density, occupational and environmental medicine. *Occupational and Environmental Medicine* 53, 241-247
- Parker A., 2005. The end of suburbia: what happens when all the cheap oil is gone and what are the health implications? *Health Promotion Journal of Australia* 16(1), 61-68
- Pedestrian Council of Australia, 1999. The Australian Pedestrian Charter [Retrieved: 13/04/2006]
<http://www.walk.com.au/pedestriancouncil/page.asp?PageID=107&SiteID=1>
- Planning and Transport Research Centre, 2005. Newslines. June, Perth: PATREC
- Ploeger J., 2003. Infrastructure planning for cycling. In: Tolley R., (Ed), Sustainable Transport: planning for walking and cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 267-281
- Pope C., 2000. Epidemiology of fine particulate air pollution and human health: biologic mechanisms and who's at risk? *Environmental Health Perspectives* 108(4), 713-723
- Powell K., Blair S., 1994. The public health burden of sedentary living habits: theoretical but realistic estimates. *Medicine and Science in Sports and Exercise* 26(7), 851-856
- Praxis Solutions, 2004. The Evolving City: an atlas of change in the City of Perth, 1990-2001. Report prepared on behalf of the Government of Western Australia, the Western Australian Planning Commission and the City of Perth, July, 120pp [Retrieved: 05/07/2007]
<http://www.wapc.wa.gov.au/Publications/276.aspx>
- Premier's Physical Activity Taskforce, 2006. Western Australia State Walking Strategy, 2005-2020. Draft as at 26 April, Perth: Government of Western Australia
- Rank J., Folke J., Jespersen P., 2001. Differences in cyclists' and car drivers' exposure to air pollution from traffic in the city of Copenhagen. *Science of the Total Environment* 279, 131-136
- Rees W., 2003. Ecological footprints and urban transportation. In: Tolley R., (Ed), Sustainable Transport: planning for walking and cycling in urban environments. Abington, Cambridge: Woodhead Publishing Ltd., pp 3-19
- Revkin A., 2001. Tiny bits of soot tied to illnesses. *The New York Times* 21 April [Retrieved: 30/05/2005]
<http://www.mindfully.org/Air/Soot-Illnesses.htm>
- Riedliker M., Williams R., Devlin R., Griggs T., Bromberg P., 2003. Exposure to particulate matter, volatile organic compounds, and other air pollutants inside patrol cars. *Environmental Science and Technology* 37(10), 2084-2093
- Ritz B., Yu F., Fruin S., Chopa G., Shaw G., Harris J., 2002. Ambient air pollution

- and risk of birth defects in Southern California. *American Journal of Epidemiology* 155, 17-25
- Rural and Regional Affairs and Transport References Committee, 2006. Australia's Future Oil Supply and Alternative Transport Fuels. Senate Committee Interim Report, September, Canberra: Commonwealth of Australia,
- Saelens B., Sallis J., Black J., Chen D., 2003. Neighbourhood-based differences in physical activity: an environmental scale evaluation. *American Journal of Public Health* 93(9), 1552-1558
- Sallis J., Frank L., Saelens B., Kraft M., 2004. Active transportation and physical activity: opportunities for collaboration on transportation and public health research. *Transportation Research Part A* 38, 249-268
- Sallis J., Owen N., 1999. Physical Activity and Behavioural Medicine. Thousand Oaks: Sage
- Scheurer, J., 2005. Travel behaviour and mode share targets in Australian cities: are we on track? *Urban Policy and Research* 23(4), 525-530
- Scheurer J., Kenworthy J., Newman P., 2005. The Economic Benefits of Investing in Public Transport in Melbourne. A policy document for the Metropolitan Transport Forum, Melbourne: MTF, 31pp
- Shore W., 2006. Land-use, transportation and sustainability. *Technology in Society* 28, 27-43
- Shoup D., 2004. The High Cost of Free Parking. Chicago: American Planning Association Planners Press
- Siegel P., Brackbill R., Heath G., 1995. The epidemiology of walking for exercise: implications for promoting activity among sedentary groups. *American Journal of Public Health* 85(5), 706-710
- Simmons M., 2005. Twilight in the Desert: the coming Saudi oil shock and the world economy. Hoboken, New Jersey: John Wiley and Sons
- Socialdata Australia, 2001. Potentials Analysis Perth, Western Australia. Perth: Government of Western Australia [Retrieved: 13/06/2005] <http://www.dpi.wa.gov.au/travelsmart/pdfs/Report.PDF>
- Standing Committee on Rural and Regional Affairs and Transport, 2007. Australia's Future Oil Supply and Alternative Transport Fuels. Senate Committee Final Report, February, Canberra: Commonwealth of Australia, 196pp
- Steiner H., 1978. Conflict in Urban Transportation: the people against the planners. Lexington and Toronto: Lexington Books
- Stephenson G., Hepburn J., 1955. The Plan for the Metropolitan Region: Perth and Fremantle, Western Australia. Report prepared for the Government of Western Australia, Perth: Government Printing Office
- Stephenson J., Bauman A., Armstrong T., 2000. The Costs of Illness Attributable to Physical Inactivity. Canberra: Commonwealth Department of Health and Aged Care
- Taylor Burrell Barnett, 2004. Liveable Neighbourhoods Policy Review Discussion

Paper: summary of analysis, stakeholder consultation and proposed policy contents. October, prepared for the Western Australian Planning Commission [Retrieved: 27/05/2005]
<http://www.wpac.wa.gov.au/cgi-bin/index.cgi?page=/udmp/index.html>

Toor W., Havlick S., 2004. Transportation and Sustainable Campus Communities: issues, examples, solutions. Washington DC: Island Press

Transportation Research Board, 2005. Does the Built Environment Influence Physical Activity? TRB special report 282. Transportation Research Board, Institute of Medicine of the National Academies: Washington DC, 248pp

Urban Land Institute Report, 2005. Higher-Density Development: myth and fact. [Retrieved: 17/05/2005]
www.uli.org/Content/ContentGroups/PolicyPapers/MFHigher010.pdf

US Environmental Protection Agency, 1998. Technical Methods for Analyzing Pricing Measures to Reduce Transportation Emissions. EPA Report No. 231-R-98-006, February, 257pp [Retrieved: 21/05/2007]
<http://www.epa.gov/otaq/stateresources/policy/transp/tcms/anpricng.pdf>

Van U-P., Senior M., 2001. The contribution of mixed land uses to sustainable travel in cities. In: Williams K., Burton E., Jenks M. (Eds), *Achieving Sustainable Urban Form*. London: Spon Press, pp 139-148

Vandegrift D., Yokel T., 2004. Obesity rates, income and suburban sprawl: an analysis of US states. *Health and Place* 10, 221-229

Western Australian Greenhouse Task Force, 2004. *Western Australian Greenhouse Strategy*. Perth: Government of Western Australia

Whitelegg J., 1993. *Transport for a Sustainable Future: a case for Europe*. London: Belhaven Press

Wooldridge C., 2005. Cycling: the re-emerging transport mode. Paper presented at the Transit Oriented Development (TOD) conference 'Making It Happen', 6-8 July, Fremantle, Western Australia

World Conference on Transport Research Society and Institute for Transport Policy Studies, 2004. *Urban Transport and the Environment: an international perspective*. Kidlington, Oxford: Elsevier

World Health Organisation, 2003. *Health Aspects of Air Pollution with Particulate Matter, Ozone and Nitrogen Dioxide*. Report on a WHO working group, Bonn, Germany, 13-15 January, 98pp [Retrieved: 08/07/2007]
<http://www.euro.who.int/document/e79097.pdf>

Wright C., 2003. Creating supportive environments for physical activity: encouraging walking. In: Tolley R., (Ed), *Sustainable Transport: planning for walking and cycling in urban environments*. Abington, Cambridge: Woodhead Publishing Ltd., pp 402-420

Zhu Y., Hinds W., Kim S., Siontas C., 2002. Concentration and size distribution of ultra-fine particles near a major highway. *Journal of the Air and Waste Management Association* 52, 1032-1042

Acknowledgements

The authors would like to thank the chief investigators involved in the RESIDE study, including Matthew Knuiman, Kimberly Van Niel, Max Bulsara, Fiona Bull, Anna Timperio, Terri Pikora, and Trevor Shilton. Thanks also to the National Heart Foundation, which is the Industry Partner for the Transport Sustainability and Health Study and to the Australian Research Council for its funding of the TSH study. Funding from the Western Australian Health Promotion Foundation (Healthway) is also gratefully acknowledged for the main RESIDE study (Grant No. 11828). The first author is supported by an ARC APAI PhD scholarship (LP0455453) and the second, by a NHMRC/NHF Career Development Award (Grant No. 254688).

Address for correspondence:

Ryan Falconer
C/- ISTP, Social Sciences
Murdoch University
Murdoch, Western Australia, 6150

Phone: 0061 8 9360 6188

E-mail: r.falconer@murdoch.edu.au

World Transport Policy & Practice

Volume 13, Number 2



World Transport Policy & Practice