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Splintered urbanism

local public space or corporate economic gain...?

Household car ownership & *'Walking for Transport'*

SUSTAINABLE MOBILITY – SEEN TO THE YEAR 2030

Cycling for active transport & recreation in Australia – Status review & future direction

PEDESTRIANISATION OF COMMERCIAL RETAIL AREAS 'Khao Road', BANGKOK

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Eco-Logica Ltd., 53 Derwent Road, Lancaster, LA1 3ES, U.K
Telephone: +44 (0)1524 63175
E-mail: j.whitelegg@btinternet.com
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Editorial

At an international conference on walking in Melbourne, Australia on October 24th 2006, a large and eager audience sat patiently waiting for the Minister of Transport of the State of Victoria to give his opening address. He did not turn up, and his absence sends a very strong message indeed to all those who work very hard to make the glaringly obvious point that walking is transport, walking is important and walking is central to everything from tackling obesity and climate change to creating high quality liveable cities. Ministers of transport tend to turn up at conferences devoted to private finance initiatives and highway construction. They will always turn up to share the limelight about transport plans related to Commonwealth and Olympic games, but walking is off the radar screen and is easily replaced by something more important even if it has been in the minister's diary for several months.

Australia is at the serious end of most transport, land use, energy and health and resource use problems. Its high levels of car use, even for short distance trips, makes it especially vulnerable to the peak oil problem and the refusal of its politicians to take sustainable transport seriously is a major obstacle to progress. Highway projects loom very large in the in-tray of ministers of transport.

The city of Brisbane in Australia has decided to build a central area tunnel at a cost of over $3 billion (Australian). The tunnel will end up costing far more than this and will be followed by many other high cost highway infrastructure projects. Brisbane's approach to transport policy is not especially unusual but does bring into sharp relief the contradictions that lie at the heart of urban transport throughout the world. Brisbane is also the location of the self-proclaimed "largest travel smart project in the world", and this project will work diligently to persuade people not to use the car. The combined highway projects and Travel Smart projects amount to a $10 billion plan to encourage car use and a $30 million plan to discourage car use. This is silly and looks especially silly when put in the context of the world-class physical environment of Brisbane and its enormously attractive walking and cycling possibilities. Brisbane has 1% of all trips currently accomplished by bike and about 80-85% by car. It is a car dependent city that is rushing headlong into higher levels of car dependency at a time when peak oil and oil dependency concerns are ringing alarm bells around the world. Car dependent and fossil fuel dependent cities like Brisbane are heading for a social and economic crisis because they cannot see the wisdom and precautionarity of moving to lower levels of oil dependency. Brisbane could easily have 10% of all trips by bike, 10-20% on foot and 15-20% on public transport but there is very little sign of the vision and clarity of thought that could produce this outcome.

Sweden on the other hand has declared its intention to become fossil fuel free by 2020 ('Making Sweden an OIL FREE Society', Commission on Oil Independence, 21st June 2006) This policy links well with its "Vision Zero" road safety policy which was introduced in 1997 and commits the country to achieving zero deaths and zero serious injuries in the road traffic environment. This remarkable double-hit will ensure that Sweden maintains a high quality

of life and an exceptional degree of insulation from global oil supply problems and price increases. Australian citizens will find themselves living in a polar opposite world characterised by oil supply crises and prices of more than $100 per barrel. This is unnecessary and Australia has the experience and the people to deliver a revolution in mobility. It simply lacks politicians with the vision and clarity of thought to recognise that reducing car dependency is a win-win situation with hard monetary and security benefits that range across obesity, diabetes, mental health, reduced fiscal demands for roads, bridges and tunnels and reduced greenhouse gases.

At the international walking conference almost 400 people gathered to discuss best practice and to assess the multiple advantages of increasing walking and all modes of sustainable transport. The majority of the participants were Australian and there can be no doubt that if these people could be given a few months to sort out walking, cycling, health and urban design and planning in Australia then all these problems would be resolved.

It is increasingly clear that politicians are out of step with the needs and requirements of the age in which we live and that a major paradigm shift is needed to deliver urgent action on climate change, transport-related health problems, cities drowning in car pollution, children damaged by noise and deeply traumatised communities. A radical shift towards walking, cycling, and public transport and traffic reduction will deliver a huge part of the solution to all these problems and will create happier citizens.

This is the major challenge of the 21st century and we will succeed. The 19th century saw major world cities installing pure drinking water systems on a huge scale. The 20th century saw the elimination of the dreaded and dreadful sulphurous yellow smog that plagued London and all major UK cites and we must once again rise to the challenge of system-wide re-engineering to restore civilisation, calm, peace and community richness to our cities.

This challenge will involve setting maximum speed limits of 30kph in all cities and banning through-traffic from residential streets. It will mean reversing almost 100 years of car domination and returning streets and cities to people. It will mean that we pursue interventions of whatever kind that protect children, the elderly and the mobility disadvantaged, and we no longer tolerate noisy, intrusive traffic near our homes and in our communities. It can be done and it will be done.

John Whitelegg
Editor
Melbourne, Australia
24th October 2006

Making Sweden an OIL FREE Society
Commission on Oil Independence 21st June 2006
http://www.sweden.gov.se/content/1/c6/06/70/96/7f04f437.pdf

Walk21 - Walking Forward in the 21st Century
http://www.walk21.com

Abstracts & Keywords

What Goes Up Must Come Down:
Household Car Ownership and 'Walking for Transport'
Hazel Baslington

This paper reports research investigating the cultural determinants of childrens' travel. The 'diary sets' kept by 301 children linked travel with time spent on physical activity over one week. Parents completed a travel and exercise questionnaire (n=136) and some were interviewed (n=22). Car use for regular journeys and time spent walking is associated with the number of cars in households. Availability of a car can reduce walking for transport but may facilitate other exercise. Possession of two/more cars extends socio-economic and geographical boundaries. A bold policy measure advocated is a 'one car' policy for households.

Keywords:
Childrens' travel, mixed method design, walking for transport, multi-car ownership, 'one car' policy

Trends, innovative course settings, and levers for mobility and transport
Seen from the Year 2030
Hartmut H. Topp

We need innovative policies to shape the future of mobility and transport. Sustainable mobility in terms of ecology, economy and social justice is the goal, even though sustainability is poorly defined in the field of mobility and transport, and, at the same time, inflationarily used. Technical innovations in transport are often discussed, but we also need economic innovations, political innovations, social innovations, as well as, behavioural changes, because sustainable mobility can only be achieved by a broad range of measurements. We need new policies and innovative course settings, because laissez-faire cause undesirable developments, such as wasting fossil energy, climate changes and natural disasters through global warming, dead-end street of automobile dependency, urban sprawl resulting in high costs, unaffordable public transport in rural areas, macro-economic losses through congestion, environmental and health damage ... The list could be continued.

Keywords: Technical/economic, social innovation, behavioural change, sustainable mobility

Splintering the public realm: using local public space for corporate economic gain?
Fiona Raje

This paper provides an example of how conflicts between transport and planning policy and practice can manifest themselves in local communities. It discusses the building of a gated community on a deprived urban peripheral estate in Oxford and the dichotomy between policy statements about promoting social inclusion and the granting of permission to construct a socially-isolating housing development within one of the city's most deprived neighbourhoods.

Key words
Gated communities, splintered urbanism, transport policy

Effects of pedestrianisation on the commercial and retail areas: Study in Khao San Road, Bangkok

Santhosh Kumar. K, William Ross

Pedestrianisation of retail areas is a strategy commonly implemented in city centres. It has various impacts on the traffic speed and increases the quality of life for the people living, working and visiting the area of implementation. In addition, it also has an impact on the commercial and retail businesses in the area of implementation. The current study focussed on determining the effect of pedestrianisation on the retail and commercial businesses of Khao San Road, Bangkok. The results of this study were in line with earlier studies undertaken in various other cities. Qualitative research methods were used in this study and the results showed that business owners reported an increase of sales volume since pedestrianisation and all respondents reported a noticeable increase in the liveability of the area. The study recommends that the implementing authorities undertake similar projects in retail and commercial areas throughout Bangkok to boost the sales volume and increase the liveability of the area.

Keywords
Pedestrianisation, Retailing, Liveability, Commercial areas, Khao San Road, Bangkok

Cycling for active transport and recreation in Australia: status review and future directions

Rissel C, Garrard J

Riding a bicycle is a potentially important but neglected form of sustainable transport that can also contribute to achieving adequate levels of physical activity. Despite the clear health and environmental benefits of cycling, there has been no systematic review of strategies to increase or promote cycling in Australia, nor any consideration of a health promotion research agenda for cycling.

This paper reviews the available Australian published and grey literature reporting evaluation of strategies to increase or promote cycling (n=17). It identifies the prevalence of cycling in Australia from a range of sources, synthesises the main influences on cycling, reviews the little available evidence of effectiveness of strategies to increase or promote cycling, and identifies research priorities.

This review has highlighted the relatively low level of regular cycling for transport in Australia, and the marked gender disparity of riders. However, cycling is a very popular recreational activity (fourth most popular nationally), suggesting that under favourable conditions some of these riders could substitute short car trips for bicycle trips. Almost all of the identified cycling promotion program evaluations have shown some degree of increase in cycling, suggesting that if they were to be implemented on a wider scale and with adequate resources they would lead to increases in population levels of regular cycling. A number of suggestions are made for cycling related research in Australia.

Keywords:
Cycling promotion programmes, strategy evaluation, cycling research

Travel in Inner City versus Urban Fringe of Adelaide:
The Role of Neighbourhood Design

Soltani A, Allan A, Somenahalli S, Primerano F

Previous literature has found that suburban development is associated with the unbalanced choice of travel mode. The micro-scale aspects of the built environment that influence modal choice, however, have not been well-established. Furthermore, the majority of the literature is from North American or European cities, thereby less Australian context. Using a sample from Adelaide, this research looked at the connection between neighbourhood design and modal choice, classifying the sample into two low-density, growing outer-ring suburbs versus two suburbs selected for their higher density, stability, and inner-ring location. Statistical analyses showed that neighbourhood design has a strong association with modal choice. Specifically, traditional neighbourhood designs are correlated with the choice of non-motorised modes, while suburban designs are associated with the choices of car driver/passenger. The multinomial logit models suggest that micro-scale urban form factors play an important role, and that travel time and commute distance also impact modal choice along with a number of social factors such as income level, employment and family structure. This study, therefore, supports the assertion that land use policies have at least some potential to reduce the choice of private vehicles, thereby reducing car dependency. This study also may serve to assist other practitioners in Adelaide in their efforts to address the issue of induce travel, and to present better solutions for sustainability concerns.

Keywords: Travel; land use; multinomial logit model; Adelaide

What goes up must come down:
Household Car Ownership and 'Walking for Transport'

Hazel Baslington

This paper reports findings from a PhD project investigating the cultural determinants of childrens' travel (Baslington, 2006). The research was in part replicatory and in part exploratory. Previous research revealed that childrens' school travel behaviour varied according to level of car ownership in household, for instance, (Roberts, Carlin, et al 1997, Davis, 1998, Mackett, 2002). Additional analysis on this variable investigated nonschool trips, short car journeys and time spent walking. The 'diary sets' kept by 301 children linked travel with time spent on physical activity over one week. Parents completed a travel and exercise questionnaire (n=136) and some were interviewed (n=22).

Sample Composition, Children

The children were aged 9 to 11 (Years 5/6) and attended eight primary schools in West Yorkshire, in 2003. Six schools are in urban areas, one a rural and another, a semi-rural district. Ninety percent of pupils lived approximately 1.13 kilometres (three quarters of a mile) from school. An indication of socio-economic status is provided by the Indices of Deprivation (ID 2000 was the index used in the fieldwork), identified from school postcodes. This ranks English districts between '1' and '8,414' on an ascending scale. Rank 1 is bottom and ten percent of districts are considered 'very deprived' (rated ID 841 or lower). Ward level data from six indices are used: income, employment, health deprivation, housing, education, training and access to services. The ID ratings are: Schools 1, 6, 7 (ID 4,518, 4,547); School 3 (5,672); Schools 4, 5 (3,378, 3,775); Schools 2, 8 (247, 298). Schools 2 and 8 are in 'very deprived' districts, included to obtain a cross-section of respondents.

Diary sets were completed by 301 children (53% response rate) by equal proportions of both sexes. They contained three colour coded sections: a One Week Travel Diary (TD) an Out of School, Sports & Exercise Diary (SED), a questionnaire. The TDs comprised a one page matrix with ample space to show trips: 'To/From' school, 'To See and Go Out with Friends' and 'Other' journeys. Children inserted daily travel mode/s, destination/s and journey times (minutes). The SED was identical to TDs except children showed time spent daily on physical activity with divisions for 'Sport and Exercise', 'Active Play/Street Games', 'O*ther* walking' (Walking or cycling not shown as transport on the TD). 'O*ther* cycling', 'Other Ways to be Active', such as housework/gardening. Examples were provided as well as open questions, 'Another Sport/Exercise…'? Demographic details collected were: age, sex, household car ownership and postcode. Diary sets included a yellow instruction sheet and were tied and protected with plastic covers. To increase motivation children were awarded a laminated 'Certificate of Appreciation' and a decorative sticker.

Sample Composition, Parents

Children took home a request letter to parents requesting participation. To obtain a sizeable sample a further seven schools (five state and two privately run) in a cross-

section of districts in another West Yorkshire town were contacted in Winter 2003/4. The parents completed a short Parents' Travel & Exercise Questionnaire (PTEQ n=136, 11% response rate). A sample of children whose parents completed the PTEQ (all schools, n=121) were used to check the accuracy of childrens' responses to the question, *"Does your family have a car? Count all types of car or van"*. A Cronbach Alpha coefficient, ά = .97, revealed a high level of concurrence.

Twenty two parents were interviewed (20 female, 2 male). Nineteen had interviews at home and three in private offices. The duration ranged from 30/35 minutes (n=6), 40/45 (n=13), 50/60 (n=3) Although self-selected, the sample represented a cross-section by age, family size (including six single parents), socio-economic status, travel mode behaviour. Of the 22: four were from '0 car' households; seven '1 car'; ten '2 car' and one had '6 cars'. A breakdown by ID is: one parent (ID 6,163); three (5,017); five (4547, 4,518); four (3,378); one (2,069); two (1,841, 1,070); five (ID <1,000), one unknown. Eight interviewees had part-time, ten full-time employment, three were 'housewives', one a student. Nine were in professional/managerial occupations, four were skilled and five semi/unskilled.

Findings: Childrens' Travel to School by Number of Cars in Household

Public transport (only 18 (7%) used a public/school bus, none used trains) was not used by the majority of pupils to travel to/from school therefore the findings for walking and car travel are reported. Data from TDs were analysed by comparing those who walked to school (4/5 days) with non-walkers. There were highly significant differences in the proportions by car ownership (to school χ^2 28.151 $p<0.001$ df 3, from school χ^2 28.156 $p<0.001$ df 3). As car ownership increases, walking to school decreases. Table 1 shows the results of the cross tabulation. National Travel Survey data showed that the decline across car ownership categories in walking trips to school is the same nationally: 82% of trips by 5-10 year olds from 'no car' households are walk journeys, 54% of 'one car' and 37% of those from 'two/more cars' households (NTS, 2004/5)

Table 1: Children, Walk to School, 4/5 Days by Cars in Household

Walk to School 4/5 Days	No Car	One Car	Two Car	Three/More M	Total
No	7 (23%)	58 (48%)	62 (63%)	40 (77%)	**167 (55%)**
Yes	24 (77%)	62 (52%)	36 (37%)	12 (23%)	**134 (45%)**
Total	**31 (100%)**	**120 (100%)**	**98 (100%)**	**52 (100%)**	**301 (100%)**

Percentages rounded to nearest 1%

The corresponding cross tabulation for 'Car to School 4/5 Days' also revealed significant proportional differences (to school, car, χ^2 31.363 $p<0.001$ df 3, from school car, χ^2 13.390 $p<0.004$ df 3). Postcode data were used to investigate if 'travel distance' to school was a confounding variable. There were no significant differences in the travel distances according to the number of cars in

households (Kruskal Wallis Test, chi-square .564 p<.905 df 3).

Travel to Friends, Other Places and Short Car Journeys

Less than 1% of children used trains for trips to see 'Friends' (some children did not make these journeys, 18% did visit friends, friends may have visited them) or journeys to 'Other' places. Nineteen (6%) used public buses to 'Friends' and 42 (13%) for 'Other' journeys. Regarding walking journeys to see 'Friends' and travel to 'Other' places, the proportional differences by number of cars in household are significant (walk to 'Friends', χ^2 11.556, p<0.009 df 3, walk to 'Other', χ^2 8.111 p<0.05 df 3). The pattern remained consistent for car journeys. As car ownership increased, the numbers travelling by car also increased (car to 'Friends', χ^2 17.335, p<0.001 df 3, car to 'Other', χ^2 19.390 p<0.001 df 1). A 'short car journey' is a trip lasting 'five minutes or less' (Goodwin 1995). The purpose of this analysis was to count the number of children, not the total per child. Overall, 272 of 301 children made car journeys and 160 (59%) of these made at least one short trip. Two thirds of children from households with two/more cars made at least one short car journey during the week (χ^2 20.037, p<0.001, df 3).

Table 2: Childrens' Short Car Journeys in Week by Cars in Household

Short Car Journey	No Car	One Car	Two Car	Three / More	Total Children
No	20 (71.5%)	50 (48.0%)	27 (29.0%)	15 (32.5%)	**112 (41%)**
Yes	8 (28.5%)	54 (52.0%)	67 (71.0%)	31 (67.5%)	**160 (59%)**
Total Children	**28 (100%)**	**104 (100%)**	**94 (100%)**	**46 (100%)**	**272 (100%)**

Percentages rounded to nearest 0.5%

Childrens' Travel, Differences in Socio-economic Status?

A comparison of children from different socio-economic circumstances strongly suggests it is the fact of car ownership rather than socio-economic differences per se, which accounts for travel mode to school. Schools 2 and 8 are in economically deprived districts, (IDs 247 and 298 respectively). In total, 49 of the 100 pupils who completed TDs live in two or three car households. However, census data showed that this proportional split is not representative of other households in the two school catchment areas. As expected, there are a greater number of 'no car' or 'one car' households. The proportional differences (there are also differences in attitudes towards cars and public buses in this subsample (Baslingtobn, 2006)) in Table 3 were highly significant with a correlation coefficient revealing a 'very strong' association between 'walk to school 4/5 days' and 'number of cars in household' (Schools 2, 8 walk to, χ^2 17.44 p<0.001 df 3, Cramér's V = .421 p<.001, (Schools 2, 8 walk from, χ^2 11.808 p<0.008 df 3, Cramér's V = .344 p<.008).

Table 3: Children from Economically Deprived Districts:
Walk to School, 4/5 Days by Cars in Household

Walk to School 4/5 Days	No Car	One Car	Two Car	Three /More	Total
No	4 (27%)	17 (47%)	14 (61%)	23 (89%)	**58 (58%)**
Yes	11 (73%)	19 (53%)	9 (39%)	3 (11%)	**42 (42%)**
Total	**15 (100%)**	**36 (100%)**	**23 (100%)**	**26 (100%)**	**100 (100%)**

Percentages rounded to nearest 1%

Similar proportions of children in these districts walk to see 'Friends' but there are highly significant differences for journeys to 'other' places (χ^2 22.001 p<0.001 df 3, Cramér's V = .512 p<.001, n=84). Of the 'no car' households: 8 (61%) walk, 'one car' 22 (73%), 'two car' 4 (22%) and three/more 4 (17%) of households walk. A plotting exercise was undertaken around the district of School 2 (48 of 52 postcodes were known) using an ordnance survey map. Street addresses were marked according to car ownership. Altogether, 17 of the 21 'no car' or 'one car' households lived in the same street or adjoining roads as those from two/more. Hence, the travel mode differences relate to level of car ownership, not area of residence or socio-economic status.

Minutes Spent Walking

The minutes spent walking during the week of diary set completion included all walking shown on TDs or SED. The mean time spent walking was 127 minutes (2.11 hrs) and median, 97 minutes (1.61 hrs), 6% did not show any walking. Table 4 provides descriptive statistics for minutes spent on 'All Exercise' and 'Walking' by number of cars in household (n=294). As car ownership increased, time spent walking decreased. The differences in physical activity only apply to walking, no other exercise subcategories.

Table 4: Children, Minutes Spent on 'All Exercise' and 'Walking'
One Week by Number of Cars in Household

Descriptive Statistics (minutes)	No Car		One Car		Two Car		Three/More	
	'All Exer'	'Walk'	'All Exer'	'Walk'	'All Exer'	'Walk'	'All Exer'	'Walk'
Mean	561	***181***	573	***129***	570	***119***	559	***98***
Median	488	*175*	459	*111*	440	*79*	440	*61*
Interquart/Range	524	***141***	529	***127***	417	***155***	700	***101***
S.D.	329	*86*	453	*102*	446	*109*	409	*130*
Sample Size	**n=30**		**n=117**		**n=96**		**n=51**	

The distribution for time spent walking for the sample of children who reside in 'no car' households was normal (Kolmogorov-Smirnov test .461 p<.984) therefore more likely to be representative of the population. The distributions for children from one, two, and three/more car households were not normally distributed therefore may not be representative.

A Kruskal Wallis Test indicated highly significant differences between the *mean ranks* for children, time spent walking in the four car ownership categories (chi-square .22.672 p<.001 df 3). Figure 1 compares the mean time spent walking by children according to car ownership categories. There were 9 extreme scores across sub samples (>375 minutes: 5 children from 'no car/one car' households, 4 children from 'two/more').

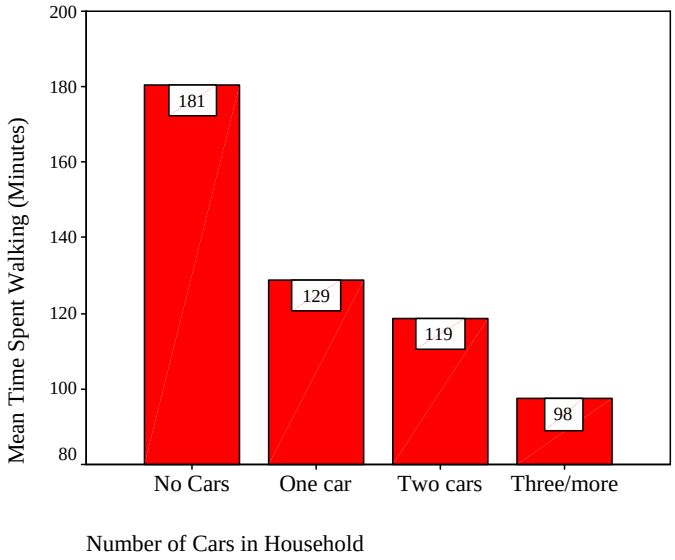

Figure 1: Children, Mean Time Spent Walking (Minutes) in One Week by Number of Cars in Households

Parents Travel to School, Work and Other Places

Similar percentages of parents in all car ownership categories escorted their child to/from school: 75% of parents in 'no car', 84% of 'one car' and 84% from 'two/more' car households (only 3 parents in the PTEQ sample were from 'three/more car households, and are included with 'two/more'). Nevertheless, the mode used varied according to 'car availability.' As the number of cars in a household increased, fewer parents walked to escort children: 15 (94%) 'No car' households walked, 17 (55%) of 'one car' and 11 (20%) of parents from 'two/more cars' households walked (χ^2 29.936, p<0.001, df 2). The pattern of results for the *unemployed* sub sample of parents was consistent with others and NTS data shows this finding is reflected nationally. Only 30% of school escort trips by the 'economically inactive' in 'two/more' car households are walk journeys compared with 53% of 'one car' and 83% of trips in 'no car' households (NTS, 2004/5).

Of 107 parents in employment: 57% travel by car, 16% walk, 11% bus, 4% train, 1% share car, 11% 'other' (use two modes car/walk, bus/walk). There were highly

significant differences in the proportions of car travellers according to number of cars in household (χ^2 30.718, p<0.001, df 2). Again, NTS data shows this finding is reflected nationally: 87% *of trips* to work by 'two/more' car households are car journeys, 5% are walk, 2% are bus journeys. For 'one car' households: 68% of trips are car, 11% walk, 8% bus. For 'no car': 15% of trips are car, 26 walk and 32% bus, 27% 'other' (NTS, 2004/5).

Few parents walked or used public transport for regular journeys to 'Other' places therefore the findings reported are for car journeys (7% used trains for full/part journey; 12% walked full/part journey; 19% used buses full/part journey). Of 102 parents who made trips to 'Other' places by car, 6% were made by 'no car' households, 34% by 'one car' and 60% by parents in households with two/more cars (car to 'Other', χ^2 22.029, p<0.001, df 2). The analysis of 'minutes spent walking' by car ownership level was repeated on the parents' sample. Unfortunately the data for this was incomplete. Walking for school escort trips was not requested, resulting in reduced totals for the 38 parents who walked. The 'time spent walking' and 'all exercise' was higher for 'no car' households but the differences in proportions were not statistically significant.

Car Usage for Exercise

Ninety-six parents (71%) travelled by car to play sport/get exercise including walking. Of these 4% use a car daily, 55% weekly, 12% twice monthly and the remainder less frequently. Of the 96, 60 had two/more cars, 32 'one car' and 4 'no car'. There were highly significant differences in 'car usage for exercise' by car ownership level (χ^2 37.134, p<0.001, df 2). The interviews enabled further investigation and parents were asked about *all* family members. Of 18 car owners, 14 named regular physical activities made easier because of car transportation. Another resided in a rural area and had no alternative transport. Activities mentioned were: gym, sports centre, swimming, tennis, football, cricket, dog walking. Typical responses were:

Q. *"Are there any ways a car helps you to be active and get exercise?*

A. *Well, to get to the pool she'll normally go with her dad at the weekend"*

(Interview No.19: 'One car' household).

A question on the interview schedule enquired about the opposite effect, if cars *prevented* exercise. Five of 18 car owners responded with a "n*o" they* did not think so. Nine parents thought it did:

Q. *"Are there any ways that you think the car stops you from being active and getting exercise at all?*

A. *Yes, because I always have to walk to school otherwise and back. By being there it just stops you being active"*

(Interview No. 20: Two car household for ten years)

The remaining four mentioned having less exercise when responding to a previous question/s about the advantages/disadvantages of having two cars, or else not having any car:

Q. *"Are there any other disadvantages to having two cars?*

A. *I think you get lazy really; it's a bit of a luxury having two cars really.*

(Interview No.13: Two car household for four years)

Q. ***"****Do you think there are any advantages to not having a car?*

A. *Yes the exercise. I think you get lazy, some people jump in the car to go down the road for a newspaper.*

(Interview No.21: One car, single parent household)

Several interviewees remarked on their decreased usage of public transport since becoming a two car household:

Q. *"Do your children normally travel with you when you go on the bus?*

A. *Yeah. It would be a bit of an adventure now, going on a bus, wouldn't it?* (looks at child). *Because we used to go everywhere on buses"*

(Interview No.3: 'two car' household for three years)

The 22 parents were asked if they liked walking and about acceptable distances. For some this depended on the context, separating walking for transport (to local shops or school) with recreational walking, for pleasure or exercise. The desire to walk or the distance did not depend on car ownership levels. Two of the four 'no car' interviewees walked only when necessary:

Q. ***"****Do you like Walking?*

A. *I don't like it – I do it, but I wouldn't say I* ***like*** *it"*

(Interview No.12: 'no car' household, interviewee's emphasis)

Discussion: Number of Cars in Household, Travel Mode and Habit Forming Behaviour

A pervasive finding is the strong link between the amount of car usage and the 'number of cars in households' (it is also associated with attitudes towards cars, public buses and childrens' future aspirations learning to drive own car (Baslington 2006)). It is the independent variable on regular journeys as well as childrens' short car journeys. Although the PTEQ sample was self-selected, the findings mirrored a national sample of school escorters as well as a sample of employees from the general population. The pervasiveness of car usage by mothers in households with two/more cars suggests a habit forming relationship signified by the gradient which cuts across car ownership categories in cross tabulations. Those of more recent second car ownership were conscious of behavioural change in relation to amount of walking and diminished use of public transport. Goodwin (1995) concludes that car dependence is a process not a state. Justifications for escorting children by car are based on social, psychological and economic variables: safety: 'stranger danger' or busy roads, time pressure, peer pressure, convenience, the weather, cost, all of which are tangible reasons. These explain peoples' needs, but not the greater usage of cars in multi-car households. Do these parents feel more threatened by 'stranger danger'? Do they have less time than others? Fear of strangers or busy roads is reason for parental accompaniment of children but does not explain car use for this purpose, except if the parent themselves feels threatened. Time pressure because of employment is an important factor, but nationally, the numbers involved are surprising. A picture of 'trip chaining' and school escort is provided by the DfT: 57% of women and 53% of men return straight home in the morning (DfT, 2005). Of the 43% who 'trip chain' only *18%* of female escorters, (17% of male) continue on to employment. Shift work or part-time employment may be explanatory, but interestingly, the unemployed in two/more car households use the same mode as the employed. Housewives have time pressures; they may be full-time carers with toddlers or elderly relatives. However, this also applies to housewives from 'no car' or 'one car' households' but unemployment appears to provide the incentive for these to walk. Distance travelled did not have a bearing, 90% lived approximately 1.13

kilometres (three quarters of a mile) from school – close enough to walk.

An issue of cause and effect arises: does the availability of an extra car/s increase car dependency or do those who lack fervour for walking, ensure ample supply of cars to avoid it? The findings from interviews suggest car availability increases dependency, but some cases of the latter are likely to exist. The interview sample contained two parents from 'no car' households who did not like it and they probably have counterparts in the car owning community. A difference is the latter can afford a car to avoid walking! This does not mean that those from 'no car' households are fitter. A high proportion of car owners used them for transport to sports centres and elsewhere for exercise. This is the likeliest explanation for the similarities in childrens' and parents' total physical activity levels across all categories of car ownership. Availability of a car can reduce walking for transport but may facilitate other exercise.

Interestingly, some households in economically deprived districts have access to several cars. One explanation is *quality* of car, owning older or smaller vehicles. Of those in the lowest income group, 46% have cars over ten years old (DfT, 2003). The cost of new and secondhand cars has decreased and although petrol prices have risen, the running costs of vehicles have risen less than the cost of living since 1980 (Hibbs, 2000). Access to a 'company car' is possible for skilled, semi and unskilled manual workers such as builders and taxi drivers. An older sibling/s may run a car increasing the availability. An economic factor may have a bearing on car usage. Two/more car families have a greater financial commitment. If they are running two cars – why not get full use from them? The nature of the PTEQ sample prevents some generalisations, parents in London use public transport more. As parents, the interviewees differ from the population of single adults. Further investigation on parental and non-parental populations using random samples of both sexes and couples without children is planned.

Transport and Recreational Walking

Children from 'no car' households spent more time walking because of limited access to cars. It is not known if the distributions for 'time spent walking' by children in car owning sub samples are representative. However, other researchers of childrens' travel have found dichotomous differences between 'car owning' and 'non-car owning' households. These are most noticeable in the statistics when the number of cars is '0-1', compared with '2-4' car households. Davis (1998) concluded that people in 'non-car' owning households walk 50% more on average, quoting NTS data. Recent findings from the NTS show the gap has widened: *"Those people living in a household with a car walk less than two thirds as far as those in a household without a car" (*DfT, 2005, Table 2.12). The NTS travel diary excludes walking *off* the public highway therefore recreational walking is unlikely to be shown. However, Table 2.12 DfT (2005) is compiled from responses to an interview question which asks about *any* walks of 20 minutes or more, on or off the public highway therefore comparisons are useful. Weinstein and Schimek (2005) stress the need for improved data collection of pedestrian travel. The American equivalent of the NTS fails to capture all walk trips. Their analysis by number of cars highlighted that transport walking is related to car ownership level whereas recreational

walking is not. A finding of Ross (2000) was that residents of economically deprived neighbourhoods are more likely to walk than those in less disadvantaged places. Van Lenthe, Brug and Mackenbach (2005) also found that those who resided in the most economically deprived areas of a city in the Netherlands were more likely to walk for transport reasons but less likely to walk or participate in sport in their leisure time. Possession of a car appeared to be associated with an increased risk of almost never walking or cycling to shops or work. Bostock (2001) found that 'no access to a car' is an indicator of low socio-economic status and also of having to walk to places because of necessity, not pleasure.

Defining 'Car Dependency' Conceptual Differences

There are conceptual differences in the usage of the expression, 'car dependency' by academics. It is applied to describe differences between individuals regarding reliance on car transportation. A proposition of Goodwin (1997) is that *"People differ"*(p.454) and he notes the wide variation of 'car dependence' in adults. People as individuals increase their use of cars, relying on them more and more. Goodwin also discusses the term in relation to social changes such as land use and provision of services which *make* people dependent on cars as a society. Brindle (2003) discusses 'car dependency' with reference to the social situation. He argues that the car is a means to an end. If there is an addiction, (implied by the word 'dependency'), it is not to cars, but to mobility. It is *"the mobility demands of our lifestyle and consumption patterns within the context of the physical, social and economic environment that we live in"* (p.65). The author identified differences in travel mode behaviour and attitude between groups of parents (mainly female) and children by number of cars in household. It is known that for one type of journey, school escort, the travel distances were very similar for most, therefore the fact of car ownership had independent effects to the social situation. Other findings for non-school journeys and short car trips strongly suggest that the number of cars in a household is a determinant on an individual's degree of car dependency.

Deterring Multi-Car Ownership

The definition of a problem has implications for tackling it. A contention of the author is that transport and social policies need to address both the individual *and* the social determinants of car dependency to be effective. Measures such as 'travel awareness' campaigns do not address the effects of a 'social' dependency on cars - they deal with individuals who are car dependent and could make some changes in behaviour. This is only part of the problem. A social dependency on cars impacts on *all* households including 'no car' households. The effects of 'social exclusion' on the latter are discussed by Solomon (2003).

Tolley (2003) discusses the contradiction in government policy: car ownership should increase and usage decrease. He stresses that owning a car is not the problem, but 'car dependence' is. Walking is unlikely to rise even if the facilities and support promised by government for a National Walking Strategy materialise. With greater economic prosperity, car ownership levels are likely to increase and the rise is an *"underlying force for reduced walking"* (p.190). A worrying trend is indicated by the statistics for 'second car' ownership in Britain. This has almost doubled since 1980: from 15% to 29% of all households.

The percentage of 'one car' households remains the same, 45%. Those with 'no car' have dropped from 41% to 26% (DfT, 2005). Another concern is that children transported by car experience a high proportion of short car trips, for instance, the 'school run' and may associate car use with this. Some of the author's statistical findings for 'one car' households are inconsistent and a likely explanation is 'single parent' families. In these there is a ratio of one car to each adult. In two parent, one car households, car usage is higher than in 'no car' households but lower than multi-car households.

Baird (1998) quotes Michael Palin, *"perhaps we will end up with a policy like Chinese birth control, one car per household"* (p.168). A system of inducements and disincentives for families to remain or become 'one car', or 'no car' households should be introduced. Road tax on a second car could be set at a higher rate and that on a third, higher still. The income generated should be hypothecated to pay for these. But the efficacy of a 'one car' policy is extremely doubtful if not incorporated with an integrated package of measures. Dobbs (2005) highlights that sustainable transport systems may have serious gender implications. Hence, a 'one car' policy should be marketed as 'car share' within families so that women are not the losers. Dealing with transport to work issues (which is one reason households obtain a second car) is of vital importance. Kingham, Dickinson et al (2001) point out that while some employers provide a car and allowances for petrol, people will not be persuaded to leave cars at home. Cullinane (1992) describes company cars as *"an unnecessary addition to the park of cars"* advocating that owners are fully charged without subsidy from government or employers (p.300). While advocating for a complete package of innovative campaigns, Meaton and Kingham (1998) stress how there needs to be acceptance that radical action is required.

Conclusions

The variable 'car availability' is normally used as an economic indicator, synonymous with higher income and residency in particular neighbourhoods. Possession of two or more cars extends socio-economic and geographical boundaries therefore the effects of multi-car ownership are not restricted to the affluent. Bold policy measures are necessary to prevent the trend towards second and third car ownership.

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Address for correspondence:

Institute for Transport Studies, 36-40, University Road, University of Leeds, Leeds. England. LS2 9JT

Email: baslington@sagainternet.co.uk

24, Rogerson Square, Brighouse, West Yorkshire, England

HD6 1TJ

Trends, innovative course settings, and levers for mobility and transport

Seen from the Year 2030

Hartmut H. Topp

We need innovative policies to shape the future of mobility and transport. Sustainable mobility in terms of ecology, economy and social justice is the goal, even though sustainability is poorly defined in the field of mobility and transport, and, at the same time, inflationarily used. Technical innovations in transport are often discussed, but we also need economic innovations, political innovations, social innovations, as well as behavioural changes, because sustainable mobility can only be achieved by a broad range of measures. We need new policies and innovative course settings, because laissez-faire cause undesirable developments, such as wasting fossil energy, climate change and natural disasters through global warming, dead-end street of automobile dependency, urban sprawl resulting in high costs, unaffordable public transport in rural areas, macro-economic losses through congestion, environmental and health damage ... The list could be continued.

Undesirable developments, like these, are avoidable; that is what I would like to show with a scenario for mobility and transport in the year 2030. Scenarios are images of possible futures following a comprehensive path - in the favourable, optimistic case with the right innovations and right political course settings at the right time. Such an optimistic scenario requires future-oriented and societally accepted innovations not only in the field of transport, for mobility and transport are tightly interconnected with space and time, settlement, communication, environment, energy, economy, life styles etc. Due to these complex interdependencies there are no simple recipes or easy successes on how to reach sustainable mobility. I choose a retrospective view from 2030 to present my scenario because I think it is more inspiring than a prospective scenario, plus it underlines the visionary character of a long-term scenario. I do not claim total completeness for my scenario, it rather contains important influences of mobility and transport in cities and regions like stones in a mosaic. And, of course, I also could draw different scenarios. For my scenario I have chosen ten topics; they reach from energy and prices for mobility over city development and life styles to different transport issues.

1. A frame for energy 2030

I invite you to leap forward with me into the year 2030. The Kyoto Protocol is now accepted world-wide; the Rio Declaration from 1992, as well as, the Agenda 21 are considered as the beginning of a new epoch of global co-operation. The CO2-problem and high prices for crude oil, since the beginning of this century, lead to a massive promotion of renewable energies. Now, in 2030, renewable forms of energy are dominating.

However, it should not be forgotten how long it took for the transition from fossil to renewable energy, and which economic and technological efforts were needed. Iceland, with its huge resources of geothermic energy, played a special role in this process. With high spare capacity of abundant electricity from geothermic power plants it established the first hydrogen-based economy of the world in 2012, including power-cell driven cars and trucks. Today (in 2030) motor vehicles are clean. In most countries half of the fleet is still based on traditional combustion engines, while new vehicles use hydrogen produced with renewable energy. The prices for energy increased drastically, which lead to better efficiency in industry and transport by more than a factor of 4.

The national economic balances were changed (starting at the turn of the century) from the gross national product to the ecological national product. This total accounting of the national economy, which considers consumption of nature and environmental burdens as cost factors, has created a new economic framework for transport and energy.

2. Physical mobility is expensive

Mobility, especially auto-mobility in 2030, is expensive. The demand for crude oil had increased dramatically during the first decade of the century and, since 2015, deliveries recurrently could not cover it. Some years later, the transition of the transport sector from carbon to hydrogen gained ground, but even in 2030 it is not yet completed; in most countries we still have an expensive double network of filling stations. Parts of the former uncovered external costs of transport caused by environmental damage, health risks and macro-economic losses through congestion are now paid by the road users through an ecological tax. Since 2012, the transport sector as a whole is involved in CO2-emission trading. Since 2006 , former tax benefits for commuters have been abolished step by step. At the turn of the century, the public bodies could no longer afford to maintain and adjust the 'free of cost' usable roads. In Germany, already in the 1990s maintenance dropped to 54 % of the actual requirement on national roads, and to 63 % on motorways.

'Make the road user pay instead of the tax payer' was the solution: In Germany, it started in 2005 with road pricing on motorways for heavy trucks; and road pricing for all vehicles on all roads outside the cities was introduced in 2012. The GPS-based on-board technology was finally successful, and proved to be extendable to all vehicles and all roads. It could also be exported to several countries. This system is self-sufficient, requiring no roadside construction and uses telematic services, which have been standard equipment in vehicles since 2010. Spatially and timely staggered road pricing was able to flatten peak volumes and to balance demand and supply. The former notorious traffic jams are now exceptions. Road pricing in cities (such as that in place in some Norwegian cities, Singapore, London or Stockholm) was not introduced in Germany cities, because planners and politicians were concerned that road pricing would make the city more expensive and thus less attractive compared to the periphery. They also argued that parking fees could have a similar effect as road pricing.

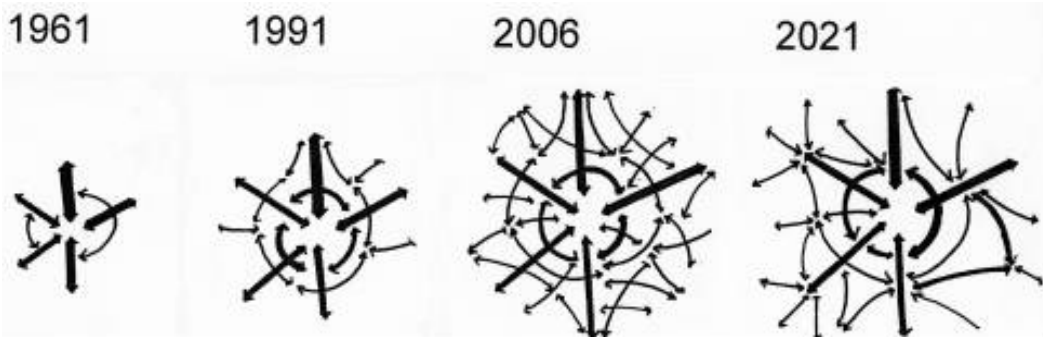
The increases of mobility prices were often protested against, but with their long-term impact and calculability they also lead to a new balance between mobility requirements

and traffic behaviour. Social hardship was compensated by a transport allowance similar to the former residence allowance for people living on public welfare.

3. Inner city development

For a long time Green land development was very common, rarely questioned and promoted thorugh tax benefits for commuters. Auto-mobility and telecommunication (together with the demand for bigger residences, cheap building plots and a family home in green areas) had dissolved spatial structures towards what we call 'Zwischenstadt'; suburbia and urban sprawl with low density, car-orientation and, finally, car-dependency. Concentrated, radial traffic flows, directed towards the city centre were becoming increasingly superimposed by peripheral flows and criss-cross flows over longer distances throughout the region (figure 1). The density of the city decreased - a process, which was additionally accelerated by demographic changes.

Figure 1: Spatial structure of travel patterns (own figure)



Parallel to green land development at the beginning of the century, new, dense and mixed-use city quarters were established on empty land abandoned by military, industry or railways. These inner city developments were very successful and they initiated a new trend 'back into the city' (Brühl et al, 2005) and the renaissance of the inner city. Attractive cities, which kept an eye on the quality of their public spaces, advertised urban culture and urbanity with success. They especially attracted the group of the 'new' old people wanting to live in an urban cultural ambience. Suburbia is not attractive for the older generation because shops, services, leisure time facilities and medical care are not easily accessible, and the car is needed for almost every journey. The traditional European inner city with its density and mixed-use areas survived parallel to suburbia and the 'Zwischenstadt'.

Inner city development (instead of green land development) with 'more mobility and less traffic' (Topp, 2003) became the most important strategy of spatial development. In inner city areas, a household can easily live with one car and (if so desired) even without a car. Here, public transport plus car-sharing is a realistic alternative. Car-dependency in suburbia on the other side absorbs more from a household's budget than is usually noticed. That can compensate for higher building costs in the inner city over a long period. In suburbia people loose not only flexibility and mobility but also economic liberties. This gained more and more importance during the years because of more expensive transport

and (at the same time) of smaller, freely disposable parts of household incomes due to more financial provision for sickness and old age. Robust and stable urban structures, at least in transport aspects with less car-dependency, became more attractive whilst car-dependent living in suburbia became less so. The planning of the 'compact city' and of 'decentralised concentration' in the region became effective, whereas today (in the year 2030) we have problem areas of urban renewal in suburbia and the 'Zwischenstadt'.

An indispensable aspect of inner city development is the quality of public spaces. Urban design, architecture, green areas and water in the city; quality of life for jobs, leisure activities and residents; and urban culture became the deciding factors within the growing competition between cities. A lack of these qualities, very often, was caused by brutal transport infrastructure. A good example is our project in Saarbrücken, the capital of the German Federal State of Saarland with 180,000 inhabitants. Here, the transport-oriented functionalism of the 1960s had perfected the motorway and, at the same time, deprived the city from its specific character and it's most important potential. There were a lot of similar examples all over the world. In the early century, a transport infrastructure cutting wounds like this into the city was no longer tolerated. In Saarbrücken, €160 million was invested in a tunnel and, in 2012 the city centre was back on the river banks. It was not only a revamp of the city centre, but also provided the turn around of a declining city, which today is better off and able to compete with prosperous neighbours such as Trier, Metz and Luxemburg. An early example similar to Saarbrücken is Düsseldorf on the Rhine River, where a similar project was completed in the early 1990s.

Figure 2a: Saarbrücken 2006: motorway along the river

Figure 2b: Saarbrücken 2012: city centre on the river banks

4. Individual life styles

Living in the city, living in the 'Zwischenstadt' (edge-city), and living in suburbia all represent different life styles. We experienced a multitude of diverse life styles, which are coined through individuality, flexibility and spontaneity. The integration of people in time and space systems has dissolved; working hours are more flexible, operating and working hours are de-coupled through widely fail-safe automation. Service hours are significantly expanded; in many cases to around the clock (car-sharing is an example). Tele-working is widespread in 2030: around 30 % of the employed work at home, mostly three days per week, plus 20 % work in dispersed tele-offices or call centres. Commuter traffic has been noticeably reduced; the traffic peaks have become less accentuated. Traffic problems (in 2030) are mainly caused by leisure activities, which, at the turn of the century already made up for about half of the kilometres covered by passenger transport. Public means of transportation, as collective means with large vehicles, do not fit too well into such a development. They have held their importance in inner cities; but in other parts of the cities and in the regions they have become more individual and more flexible. The individual forms of locomotion (foot, by bicycle and by car) have gained further meaning. The bicycle, in a stylish high-tech form now is a symbol for independence, individuality, and healthy living.

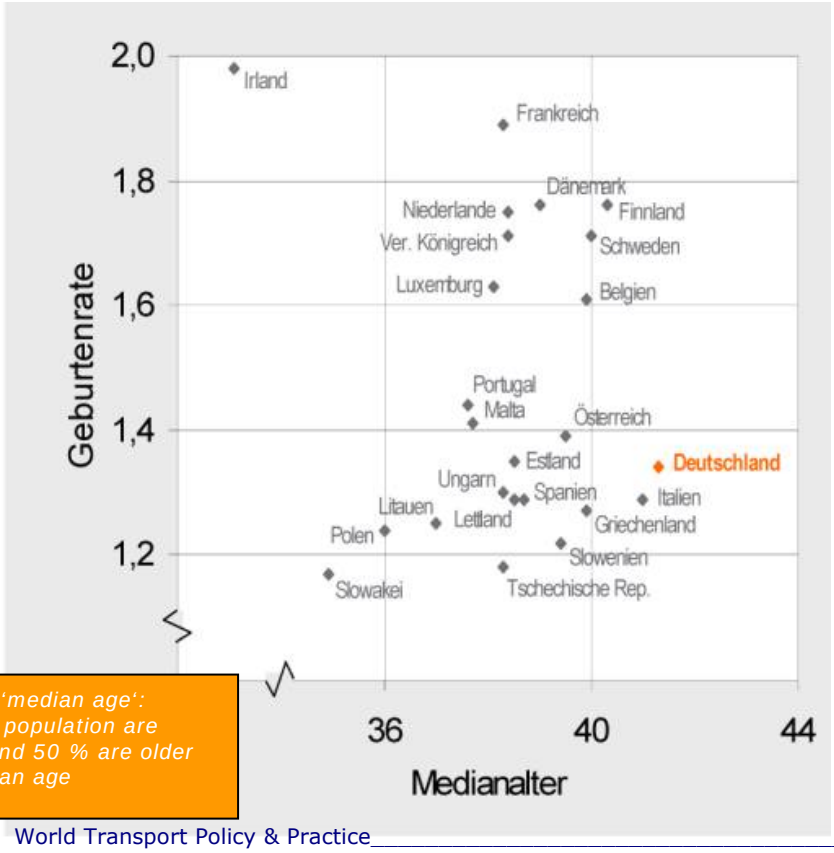
5. Demographic change and mobility

World-wide the population is still growing. In Europe, however, the population has been shrinking since about 2015 and societies are rapidly ageing. In Germany, for instance, the birth rate had sunk to 1.3

children per woman at the beginning of the century; later it stabilised to about 1.4 (Statistisches Bundesamt, 2003), whereas 2.1 would be needed to maintain the population constant. A table comparing median age and birth rate in the European Union in 2003 shows Germany with the oldest population and one of lowest birth rates, while Ireland had the youngest and most reproductive one. Iceland would stay in this chart almost exactly where Ireland is. In Germany, even though immigration was made easier, it could not make up for the low birth rate.

The other component of the demographic change was the continuous ageing of societies and that happened all over Europe due to higher life spans. In this respect, Iceland is no exception. In Germany, the number of older people over 60 grew by 41 % since 2003, while the figures for the population under 20 dropped by 19 %.

Figure 3: Median age and birth rate in the European Union 2003



Definition 'median age': 50 % of a population are younger and 50 % are older than median age

Regional differences are more interesting than the generalised figures for a whole countr. Due to regional migration within a country and different chances of regions to attract migrants from outside, the differences between prosperous and shrinking regions grew. The spatial planning objective of equal living conditions was no longer achievable. In 2030, we have prosperous, stagnating and shrinking regions side by side with the biggest problems in peripheral rural areas.

6. Public transport

Public transport was affected through demographic changes in several aspects. First, with fewer students, the biggest group of public transport users collapsed; in rural areas the backbone of public transport was affected. Second, less people working resulted in less commuter rides - which were, at the beginning of the century, a strong column of public transport. Thirdly, the older generation of 2030 (having grown up with the car) drive longer and more than the generation before. Decreasing body strength speaks more for the car. Decreasing speed of reactions is compensated by defensive driving and automatic driver's assistances. Walking disabilities are less restricting in a car than in public transport; the desire to live self-determined as long as possible, has postponed a move away from the car. According to the saying, 'You are only getting old, when you can't drive your car anymore.'

The car industry has quickly focused on the fast

growing group of older customers with 'age-adjusted' cars (comfortable getting in and out) and with all possible drivers' assistances. Barrier-free public transport in the sense of 'universal design' without any impediments concerning access and usage has been taken for granted for a long time. Age-adjusted and barrier-free public transport means (beyond the elimination of physical barriers) comfort, direct connections and simple handling before short travel times and transfers. 'Captive riders' (young people under 17 or 18, or older people without a car) have become fewer; occasional customers, those who are free to opt for modal choice, regular choice riders and older customers have higher demands for transport supply, information, liability, service, security, and cleanliness. In 2030, the public transport customer is the 'king'. Passenger rights include a 'mobility guarantee' in case of late arrivals and missed connections; customer-oriented service and information leads to better understanding of any inconvenience. Understanding improves the transport climate as well as customers' satisfaction and loyalty. High functional and aesthetic design of stops, helpful staff members, electronic tickets or mobile phone tickets instead of ticket machines, enough seats, good vehicle climate and design are 2030 customers' basic claims.

How was public transport able to manage the split between a difficult market and the needed quality jump? At the start of this century, public transport in several countries of the European Union was on the border line: in addition to the demographic changes it had to face liberalisation and competition, cuts into financial budgets according to European harmonisation and freedom of competition, tight finances of public bodies, the retreat of the state from public provision and more disperse traffic patterns in time and space. These influences, as adversaries of public transport, could hardly be controlled by planning or political measures. They resulted in a far-reaching restructuring of transport authorities towards higher efficiency. In about 2012, when car driving became significantly more expensive new financial opportunities for public transport were opened. According to the principle 'transport finances transport' public transport received transfer payments from the general road pricing of all vehicles on all roads outside the cities. This was the precondition for a new, quality public transport.

7. Mobility association with car-sharing

Since the beginning of this century public transport and car-sharing co-operate under the common roof of the so-called mobility association. This means the total integration of walking, biking, public transport, car-sharing, dial-a-bus and taxi (physically and spatially), as well as in terms of information and organisation. Public transport authorities evolved into comprehensive mobility providers offering integrated mobility or 'seamless travelling'. The mobility association created a competitive alternative to the private car. Car-sharing became the 'public car' and the forth column in the mobility association additional to walking, biking and public transport.

Car-sharing started at the end of the last century as an ecological niche product. Soon, it became strongly professionalised developing into a country-wide, high-tech service with chip-cards, satellite-based GPS-navigation, travel data compiled by on-board computers, automatic phone and internet-based booking systems etc. Instant access without reservation, open end and

one way use are taken for granted since 2015.

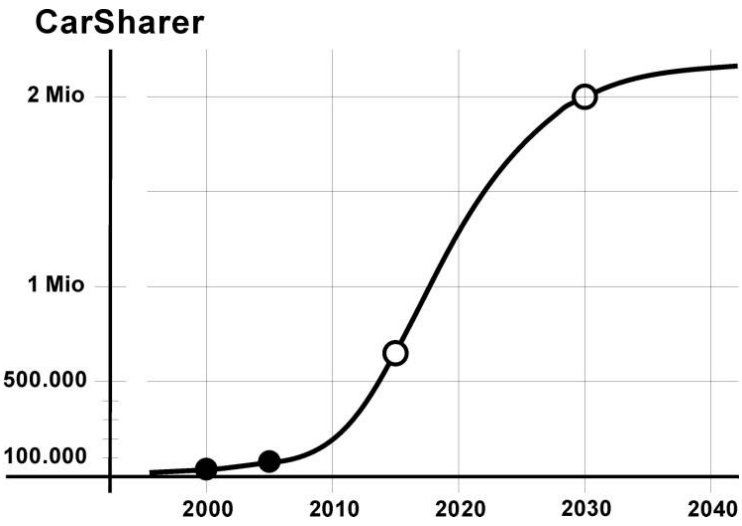
A pioneer in the co-operation between public transport and car-sharing was the Transport Authority of Zürich, where in 1995 the brand 'züri mobil' was coined. The next milestone of integrated mobility was set by the 'mobility packages' in the cities of Freiburg and Hannover. This was a comprehensive service providing information directed at satisfying customer's mobility demands in a fast, convenient, reliable, and cheap manner with the most appropriate mode of transport. By 2007, car-sharing spaces in Germany were legally established within the public realm and similar to taxi stands. The public transport stations thus evolved into mobility stations, which are now common all over the cities.

In Switzerland (as early as in 2005), car-sharing had 60,000 customers and almost 2,000 cars. In Germany, similar numbers were only reached by 2010 within the mobility association (That means 650,000 considering the different populations) (see Figure 4). More and more people considered car ownership to be expensive and inefficient. Indeed, so it is. At the beginning of this century, a private car on average was only driven one hour per day. It was parked uselessly somewhere at the roadside or in a garage for at least 23 hours. On the other hand, integrated mobility offers the appropriate transport mode for different purposes: for every occasion, at any time, the right car at the right location. This is a both a convenient and fun system which saves a lot of money due to the fact that buying, maintenance and servicing of the car is taken care of by others.

Mobility chains are getting more flexible and more individual if I can return 'my' car-sharing car without searching for a parking space and not having to pick it up on my way back.

When auto-mobility (around 2012) became significantly more expensive, car-sharing reached the steep slope of the common s-shaped logistic curve of market penetration and, finally, today's position in the mobility market with 2 million car-sharing customers and 65,000 cars in Germany (Topp, 2005).

Figure 4: Market penetration of car-sharing in Germany (own figure)



8. Intermodal transport system

At the beginning of the 21st century, the most important challenge in transport planning was the physical connection of the different transport modes, as well as their informational and organisational networking. Information technologies merged with transport technologies pushing forward transport innovations. Physical and virtual mobility grew together. In 2030, the system limits of the former separated transport modes are abandoned: cars and bikes have become more public through car-sharing and bike-sharing schemes; collective public transport is part of individual mobility chains which are established through individual information. The former spatially and modally separated

transport control and management centres have merged.

Since 2012, cars and mobile phones as mobile detectors were collecting inter-modal traffic data as floating car and floating phone data. Taxis and buses with special sensors are working as floating car observers delivering dynamic data (while on their routes) of traffic volumes and speeds, lengths of jams, hold-ups and roadside parking occupancy.

This floating data is coupled with data from stationary detection by video or ultrasound for traffic light control, public transport management, parking guidance and road pricing. In this way, actual information is gained about traffic flow, disturbances, mode and route choice, and origin and destination of journeys. Short term prognoses, based on this, manage on-line signal settings, public transport operations, and individual guidance systems for route recommendations and passenger information.

The PTA - the Personal Travel Agent - not any longer car-bound, but now integrated in the mobile phone - facilitates individual mobility chains. It informs, books services and bills the user for them. Inter-modal mobility providers have excellent business. The car industry has developed into a mobility industry, which still produces 'hardware' like cars, buses, trains and stations as interfaces, but now sells these as a 'mobility package' including the accompanying 'software' and service. At the start of the century the electronical mobility card was established. Chips integrated in mobile phones, watches or mobility cards in the form of a 'Be in/Be out' system detect the presence of a customer without any co-operation from him or her needed. The system covers road fees, booking of a parking space, parking fees, taxi, public transport, car-sharing, bike-sharing, mobile phone and internet. The mobility invoice comes monthly on the basis of 'best price', which takes into account all benefits or additions during peak times.

9. Virtual mobility

Virtual mobility was the big hope at the beginning of the century. The question was: will information and communication reduce physical transport? Derived from the 'never-ending' story of information and transport (Cerwenka, 1989) the answer could only be 'no'. On the contrary, it had always been the case that new technologies build up information and transport as well. Of course, tele-working, tele-banking, e-commerce, tele-learning and tele-conferences replace physical transport, but at the same time, the range of actions and the frequency of contacts of companies and persons are increasing, finally resulting in new transport over longer distances. The telephone also had not been able to curb transport: 'Over the phone more appointments are made than cancelled'. E-commerce finally lead to a strong increase in deliveries. Despite sophisticated logistics, the multiplying instant deliveries could hardly be combined.

Nevertheless, in 2030 we have experienced that this amplifying process of parallel growth of transport and information did not continue because transport became more and more expensive and communication cheaper and better. Nowadays, the virtual visit to a museum provides more background information than did the traditional visit. Virtual city tourism brings us not only into present cities, but also into past and future cities. What is still lacking with cyber excursions is the sensual experiencing of other regions and other people - a reality close tele-presence is still

in the pipeline. For many purpose oriented activities, easily accessible, cheap and top quality communication is a substitute for time-consuming and significantly more expensive transport.

The 'virtual' globalisation has gained momentum. The 'real' globalisation however (represented by global flows of passengers and freight) slowed down. Regional economy cycles and continental tourism were backed up. The exotic fun (as far as it survives in the globalised world) is expensive. Through 'virtual' mobility finally, around 2010, the already in the 1990's discussed de-coupling of economic growth and transport development could be achieved.

10. 'Vision Zero' for traffic safety

In 1997 the Swedish Parliament proclaimed their 'Vision Zero'; a vision that nobody should be killed or severely injured in road traffic. The effect of a vision lies on the way to the goal. Whether a vision is one-to-one achievable or not is less important. In Germany, the country of fast cars and fast driving, and where speeding as the major cause of heavy accidents was a taboo, 'Vision Zero' for a long time had no chance. It took society until 2010 to no longer accept more than 5,000 people killed and 80,000 severely injured in road traffic accidents. New speed limits were introduced: 130 km/h on motorways, 80 on highways and 30 within the cities.

A further developed jurisdiction ensured that the operators of the privatised roads have to guarantee a defined standard of compliance with the rules by enforcement, otherwise they share responsibility in case of an accident. Traffic safety was significantly improved. The speed problem was further resolved when, in 2015, the 'Intelligent Speed Adaptation (ISA)' (figure 5) was introduced (Menzel, 2004). It functions very simple: the electronic town and road maps of the 'travel pilot' were complemented by the respective speed limits. The information about a speed limit is mechanically transformed by the accelerator or by the throttle in a way that accelerating beyond the speed limit is either not even possible or only by a kick-down procedure as we know from the speed controller. In 1998 I already drove such a car in Lund, Sweden. You get accustomed to it very quickly and I found it very convenient.

Figure 5: Intelligent speed adaptation - ISA

The car of 2030 has, beside the 'Intelligent Speed Adaptation', a lot of 'intelligent' driver assistants like headway control, lane changing warning or parking assistance ... The car has increasingly become a rolling computer. Nevertheless, automatic driving (demonstrated in the 1990's) has not yet been introduced. The car industry, as well as the road operators, is still afraid of the product liability.

11. Résumé

My scenario 2030 for mobility and transport in regions and cities contains elements which are controllable by planning and politics to very different extents. There are trends (figure 6) like the world-wide

increasing demand for energy, more expensive mobility, flexibilisation of time and space structures, demographic changes with the ageing of societies, merging of information technologies into transport etc.

As mega-trends these developments are hardly steerable by planning and politics, but we have to face them in order to be prepared and to adjust to them.

Figure 6: Trends, course settings, and levers for mobility and transport

(Mega)trends	**Course settings**	**Concrete measures as levers**	
□ increasing demand for fossil energy □ mobility is getting more expensive □ suburbanisation, urban sprawl and 'back to the city' □ more individual life styles □ more flexible time and space structures □ ageing of populations □ merging of physical and virtual mobility □ total telematisation of the transport system □ ...	□ support of renewable forms of energy □ true costs in transport including 'external' costs □ user financing of road infrastructure □ transit-oriented settlement structures □ inner city instead of green land development □ reforming the financing of public transport □ barrier-free 'universal design' □ integrating modes in the mobility association □ 'Vision Zero' for traffic safety □ new mobility culture and traffic behaviour □ ...	□ ecological tax □ emission trading in transport □ cancelling benefits of commuters' □ road pricing for all motor vehicles □ compensating for social hardship □ urban quality and barrier-free cities □ noise protection & traffic calming □ service offensive of public transport □ e-ticketing instead of ticket machines □ road toll pays for public transport	□ flexible public transport in rural areas □ from car-sharing to the 'public car' □ car-sharing spaces licensed □ multi-modal mobility stations □ merging of traffic management agencies □ automatic traffic data processing □ speed management □ parking management □ promoting pedestrian and bicycle traffic □ ...

Political planning and innovative course settings (figure 6) for future developments (like renewable energies, true costs of transport, transit-oriented settlement structures, inner city development instead of green land development, integrating transport modes within the mobility association all need comprehensive packages of measures, and we have to carefully consider their possible undesired side effects. So for instance, the basic claim for true costs in transport is closely connected with the price for mobility, and therefore it has to be introduced gradually step-by-step, so that it does not overburden economy and society.

Beside trends and course settings there are, finally, many concrete measures which serve as levers (figure 6) in planning and politics, as for instance, an ecological tax reform, emission trading in transport, road pricing for all motor vehicles, a service offensive of public transport, promoting walking and biking, from car-sharing to the 'public car', multi-modal mobility stations, merging of traffic management agencies, intelligent speed adaptation and more. We have a lot to do to achieve more sustainable mobility.

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Address for correspondence:

Imove, Institut für Mobilität & Verkehr
Institute for Mobility & Transport
Kaiserslautern University of Technology
Germany

hartmut.topp@imove-kl.de

Splintering the public realm:

Using local public space for corporate economic gain?

Fiona Raje

Introduction

This paper reflects on empirical evidence from recently-completed research on transport and social inclusion which revealed an apparent gap between stated local authority policy and actual planning practice in the urban environment.

The wider research looked at the ways in which people in two case study areas in Oxfordshire in the UK experience the transport system and how this affects their ability to access key services, activities and facilities. The findings described here concentrate on one of the main issues revealed in the urban case in Barton, an urban peripheral estate of Oxford. The paper looks at how local authority planning decisions may conflict with their own Council's stated policies and how the manifestation of this conflict can contribute to social exclusion in neighbourhoods which are already vulnerable to the effects of social inequalities.

Background

The concept of "splintering urbanism" was developed by the UK urban planning scholars Stephen Graham and Simon Marvin who were responding to "what we feel is an urgent need: to develop a more robust, cross-cutting, international, critical, dynamic and transdisciplinary approach to understanding the changing relations between contemporary cities, infrastructure networks and technological mobilities" (Graham and Marvin, 2001:33). The authors argued that "a parallel set of processes are under way within which infrastructure networks are being 'unbundled' in ways that help sustain the fragmentation of the social and material fabric of cities" (Graham and Marvin, 2001:33). MacLeod (2004:28) provides an overview of some of the features of the concept:

> Blending several theoretical perspectives and deriving their analysis from a truly impressive range of cities stretching across the global 'north' and 'south', Graham and Marvin position the emergence of features like gated communities, US-style privatised Business Improvement Districts, self-enclosed shopping malls, and edge city developments within a broader context of political economic transition. In particular, and importantly, they locate such trends within the shifting contours of state power and the practices of and limits to urban and regional planning.

The concept of fragmentation of the public realm is relevant to discussions of transport and social inclusion since any "splintering" which may occur would be counter to the objectives of lessening social exclusion. To this end, in this paper we examine one of the features of Graham and Marvin's splintered urban environment in greater depth: the gated community, a residential area with restricted access:

> Through the establishment of designated perimeters (usually in the form of walls or fences) as well as controlled entrances, gated communities are intended to prevent intrusion by non-residents. For some scholars, they are deemed to be precipitating a private world that shares little with its neighbours or the larger political system leading to a fragmentation that "undermines the very concept of *civitas* – organised community life" (Blakely and Snyder, 1999). (MacLeod, 2003:5)

A history of residential separation in Oxford

While not as prevalent in European societies as in many other regions of the world, the gated community is showing a rising presence in the UK. There are now over 1,000 gated communities in England with most being found

in the wealthier south east and London in particular (Atkinson and Flint, 2003).

The physical separation of one residential area from another has an infamous precedent in Oxford. In the 1930s, rapid growth of the motor industry brought an influx of immigrants from other parts of the UK to Oxford. There was a resultant pressure on the city's limited housing resources:

> The council estate at Cutteslowe became notorious in 1934 when developers of an adjoining private estate built walls to prevent the council's tenants from using its roads: it was alleged that the tenants were former Oxford slum-dwellers, although most of the houses were inhabited by newcomers to the city. The council was not able to compel the demolition of the walls until 1959. (Crossley, 1979 @ **www.british-history.ac.uk/report.asp?compid=22805** accessed 270505)

One of the newest gated communities is being built in Barton (see Plate 1). The gated Barratt Homes development "Jazz" is located on the site of the former local pub, The Fox, adjacent to local authority-owned flats and is being sold as:

> A modern gated development…the development is within close proximity to the Headington Roundabout and has easy access to the A40 and links to the M40. Buses to Oxford Central and London a short walk away. (http://www.barratthomes.co.uk/searchres.cfm accessed 281004).

The apartments are being marketed without reference to the Barton estate upon which they are built, their location being advertised as "Headington, Oxford" – the more socially salubrious adjacent neighbourhood. The marketing information indicates that the development's main attribute appears to be that it is located near to the main inter-urban road network for ease of access to the Oxford-London corridor. The Barton estate has seen other private developments being built within its boundaries but the establishment of a gated community represents another factor contributing to the further fracturing of the local community fabric.

Plate 1: Gated development adjacent to local authority housing, North Way, Barton

Source: Fiona Rajé

The gated community in the wider community

The literature of the post-apartheid South African city describes gated or walled communities as "security villages" (Jürgens and Gnad, 2002:337). There may be some merit in viewing the development in Barton in such a light. Villages tend to be isolated with access to many facilities and opportunities being dependent upon car access: this is a characteristic of the Jazz development. Similarly, building housing with restricted access in an area that is commonly associated in the media with crime intensifies the perception of personal risk to new residents without the security of the gates and walls of the security village. The very fact that the development is gated implies to a purchaser that the area around their new home is not a space to be explored but to be accessed by car from the conveniently located trunk road network. By extension, making social connections with local residents outside the gates may be equally liable to associations with dubiety.

Atkinson and Flint (2004) argue that gated communities are not only an example of residential segregation but are also symbolic of a contemporary turn towards segregation and social withdrawal which necessitate urgent policy intervention:

> In contrast to the view that gated communities provide an extreme example of residential segregation we go further and argue that the time-space trajectories of residents suggest a dynamic pattern of separation that goes beyond the place of residence. Gated communities appear to provide an extreme example of more common attempts by other social groups to insulate against perceived risk and unwanted encounters. Patterns of what we term time-space trajectories of segregation can thereby be seen as closed linkages between key fields, such as work and home, which enable social distance to be maintained and perceived risks to be managed by elite social groups. We conclude that gated communities further extend contemporary segregatory tendencies in the city and that policy responses are required which curtail the creation of such havens of social withdrawal. (Atkinson and Flint, 2004:875)

The gated community: the policy conflict

The emergence of a policy discourse on gated communities raises concerns about the objectives of the local planning community. MacLeod (2004:20) reports that "some commentators imply a causal link between gating and social exclusion". By granting planning permission for a gated development, regardless of any clauses that may have been associated with the permission to help assuage negative impacts, brings into doubt the vision of the local planning authority. *(It is understood that when permission was granted for the developer to demolish the existing pub and build apartments on the land, an agreement was made for the housebuilder to provide a new pub in Barton. Subsequently, the building company abandoned plans to build the new pub. Negotiations between the local authority and developer were on-going during the research period and it has since been reported that an agreement has been reached whereby the housebuilder will pay £140,000 of the £300,000 required to refurbish the sports pavilion on Barton's recreation ground. The balance of funding will be sought through an application to the National Lottery Fund. (Sources: Oxfordshire County Council website www.oxfordshire.gov.uk and "Developer will help fund £300k refurbishment" Oxford Times/Oxford Mail website www.thisisoxfordshire.co.uk accessed 220105).*

Oxfordshire County Council's social inclusion scrutiny review clearly states that promoting social inclusion is a key role of the authority:

> 'Social inclusion' is not just 'jargon', but refers to the core work of the Council: helping people to fulfil their potential and to overcome the disadvantages that they might face. It is vital

that good quality services are provided to all people, especially those who are potentially vulnerable and need support. Social exclusion, whether through low income, poor educational achievement, illness and disability, isolation or other circumstances, is a loss to the whole community, and as a Council we have a responsibility to tackle both the causes of social exclusion as well as the outcomes. (Oxfordshire County Council, 2004:3)

However, the report goes on to reveal that it found a need to weave social inclusion issues through all Council policy and activity. It was critical of the lack of a corporate social inclusion strategy, a deficit of resources to coordinate social inclusion promotion, the absence of a joined-up approach to social inclusion and expressed a need for greater corporate commitment to the social inclusion:

The Review found that although many officers were committed to broad principles of social inclusion, there was not a common understanding of what that meant to the Council, or what the Council's aims were for disadvantaged people. There is insufficient lead from the Executive or the County Council's Senior Management Team on co-ordinating social inclusion activity or providing a strategic focus. This makes it harder for individual service managers and officers to pursue social inclusion activity, or to get guidance on their social inclusion priorities. (Oxfordshire County Council, 2004:3)

Given the above, there may be an unintentional lack of awareness of the ways in which a gated community may impact a local community negatively amongst the planning officers of the Council. It is imperative against such a background that empirical studies of impacts of new types of developments should be carried out and findings fed back into future decision-making within the Council as well as being shared with other authorities. Evidence-based planning can do much to preclude the negative impacts of decisions that have not taken full account of consequences on the wider community. Pressure from developers to secure land adjacent to road networks and pressure on planners to secure investment in road improvements by developers can cloud judgement, obscuring professional sensitivity to softer impacts which may have more far-reaching effects on local people. In this case, such as sanctioning the socially exclusionary use of land formerly occupied by the only pub on the estate. The absence of a local pub precipitates the need to travel away from Barton to go to a pub and the closure of the pub has removed one of the only spaces for social gathering from the neighbourhood.

Along the road from "Jazz" is "Renaissance Park" another Barratt Homes development, not gated but also marketed with a distinct emphasis on its convenience for access to the inter-urban road network:

An appealing development…with access to the M40 – London and Birmingham – A40 to Whitney (sic)- and Oxford City Centre' (**http://www.barratthomes.co.uk/searchres.cfm** accessed 281004)

Staying with the issues related to the planners' decision to allow the gated development and the neighbouring housing site to go ahead raises another concern about the apparent disconnection between the authority's statements that it promotes public transport usage and less dependence on car travel. The marketing of the two developments makes it clear that the car-owning public is their target market. The premise of car-based travel associated with the new housing runs counter to the Council's policy on transport and development:

Oxfordshire County Council's Structure Plan reinforces PPG13 - the Government's planning policy guidance on transport - by aiming to reduce the need to travel by private car through

> land use planning policy…More generally, the Structure Plan policies seek to ensure that developments are located and designed so as to be easily accessible by walking, cycling and public transport. (Oxfordshire County Council, 2000:25)
>
> Oxfordshire County Council's Residential Design Guide… is intended to inform and guide developers to provide developments which encourage more sustainable travel by minimising the need to use cars particularly for shorter trips to local facilities. (Oxfordshire County Council, 2005:ch1 p3)

Arguably, the two housing sites are located "to be easily accessible" by walking and cycling: that is, if one does not feel uncomfortable walking through underpasses to access facilities outside the estate, having to dismount from a bicycle to use an underpass or face the challenge of negotiating large volumes of circulating traffic at the Headington Roundabout – a large junction where the volume of inter-urban traffic transiting the roundabout has led to reports of delays of up to 20 minutes for traffic exiting the Barton arm of the junction at peak times (Rajé, 2004). Similarly, both developments are near to bus stops. However, the buses pass these stops as they enter the estate and passengers boarding here would have to travel through several other streets on their journey back to the main roundabout, out of Barton and on towards Oxford city centre. It should also be pointed out that the buses only operate along one route from Barton, to Oxford and on to Kidlington, resulting in the need for interchange to access some destinations, while others, often relatively nearby geographically, are effectively inaccessible by bus. Therefore, the private car again becomes the most suitable solution to the in-migrant's transport needs. It also protects him from perceived potential perils beyond the gates of his manufactured community.

However, despite the actions of the developer, Barratt, in overtly marketing these properties in terms of their proximity to the inter-urban road network and the concealment of the development's location under guises such as "Headington" and "Northway" rather than Barton (which can only serve to undermine the fabric of the local community), the house builder promotes itself as "Britain's leading urban regenerator" (The Oxford Times, 06 May 2005: 47). In an article entitled "Barratts regenerate local brownfield sites", a mythology of intention appears to be peddled:

> House builder Barratt…is transforming derelict land and recycling redundant buildings to create new communities around the UK…Barratt Maidenhead has successfully transformed the former site of the derelict Fox pub, in Northway, Oxford, into its stylish and popular Jazz development…
>
> 'We have successfully recycled all kinds of sites, which have made good use of valuable land resources, helped to meet the strong demand for new homes and also brought life back to urban areas, producing a wide range of benefits for local communities and the environment…Regeneration can reduce the need for new infrastructure, produce sustainable residential developments and help re-form communities nearer their workplaces, lessening car dependency.' (The Oxford Times, 06 May 2005: 47)

Despite the noble aims expressed by Barratt group chief executive, David Pretty, in the quote above, this research indicates that a small community of car-dependent professional commuters are likely to live in the gated development. Working away from the area, they would have little opportunity to mix with anyone beyond the gates and local people would gain nothing by having the new residents living in their neighbourhood.

How this development may bring life back to this peripheral urban area or produce a wide range of benefits for the local community and environment is not readily apparent. What does appear to emerge, instead, is a causative connection between the proximity of the urban road network and the availability of brownfield land to be developed under the guise of regeneration. If lessening car dependency was truly the developer's objective, a site with greater propinquity to the public transport, cycling and walking networks would have been more attractive. Thus, in a competitive and highly-lucrative housing market, the road network enables exploitative development to take place, that is, development that goes against the principles of social and environmental sustainability. This raises concerns about the acceptability of such enclaves in an area which has already been singled out as in need of regeneration (i.e. in need of the development of a sustainable community). It would appear that rather than contributing to the regeneration of Barton, this is an example of selective social exclusion with the transport system allowing enclave-dwellers the flexibility to look beyond their own locality for social, employment and other life opportunities.

Conclusion

In summary, the granting of permission to build a gated community in a deprived neighbourhood may be interpreted as a form of complicity between institutional actors, house builder and local planning authority, in perpetuating and extending socially divisive and exclusionary features in the built environment. To local people, planning decisions such as this imply a lack of engagement of public service providers with estate communities. Residents feel, as a result, that decisions have been imposed upon them with little understanding of their circumstances and that they have little or no say in decisions about their neighbourhood. As a result, the local authority may become associated with the arbitrary exercise of power on an estate, rather than being seen as on the side of the residents (Page, 2000).

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Address for correspondence:
fraje@ouce.ox.ac.uk

Effects of pedestrianisation on the commercial and retail areas:
Study in Khao San Road, Bangkok

Santosh Kumar & William Ross

Introduction

Cities are becoming increasingly car dependent and are rapidly being redesigned to make car travel easier. Developing countries are framing policies that will encourage motorised travel with a consequent reduction of non-motorised modes. These policies seldom consider the urban poor and the more vulnerable transport users such as pedestrians and cyclists.

Outside of newly built, gated residential and commercial areas, improved car access has generally resulted in poorer access for walkers (Ravetz, 1980). The amount of space devoted to the car in terms of road and car parking has grown throughout the twentieth century, although it is not commensurate with the increase in road traffic. The increase in the car dependant nature of neighbourhoods has reduced the business of small shops within the neighbourhoods as the large department stores are easily accessible by car and also provide sufficient, usually free, parking. This car friendly change in neighbourhood design encourages people to drive more for a trip that could often be fulfilled by a walk within the neighbourhood. Higher road traffic levels also had major impacts on the levels of social interaction and community connectedness at the neighbourhood levels (Ross, 1999). From a study in San Francisco, it was found that the community interactions were more in areas with less traffic and people had more chance to meet and had good social activities in these areas (Whitelegg, 1993; Appleyard, 1981).

In order to obtain the positive effects for the community, several car restraining measures have to be implemented. These measures include economic instruments and physical

Plate 4: Khao San Raod during the night bustling with visitors

changes through traffic calming. Pedestrianisation and traffic calming have proven to be effective measures of improving lifestyle and safety to the residents. A study of traffic calming areas in the UK showed that there was a 29% reduction in accidents to cyclists of all age groups and especially for children where the figures fell by 48%. The study also found an overall accident reduction of 60% after implementing traffic calming (Weber and Mackie, 1996 cited by Galway Cycling Campaign, 1999). Similarly results of large scale traffic calming project in the Dutch cities, Eindhoven and Rijswijk, found that the accident rates were reduced by 80% (Schlabbach, 1997). Pedestrianisation measures are best undertaken at a local level. The down side of implementing is the frequent objections during implementation. The objections are sometimes justified since no design method is without problems (Roberts, 1981). Local businesses frequently object as they feel that pedestrianisation removes the business from passing traffic. This perception has been proven wrong by various studies (Hass-Klau, 1993; Drennen, 2003; Kumar, 2006).

Pedestrian areas are the places with high walking densities. The walking does not only denote the purpose of commute but also represents the way the walkers feel about the city. People usually have very few places to meet in a car dependant city; these places include shopping complexes or conferences. However, where public spaces are more attractive then an increased meeting of people in these precincts can be noticed, Central-European countries provide good examples of public precincts. The success of a city centre cannot only be understood from an idea of reducing traffic problems but increasingly from the amount of people who benefit from them in a recreational way (Monheim, 1992).

The dramatic change that pedestrian precincts have brought to some cities in Europe can be inferred from high pedestrian volumes and also from the new businesses and shopping malls developing in these city centres (Monheim, 2001).

Pedestrianisation has a positive effect on the businesses in the area of implementation. The effect is usually in the form of increased turnover, increased property values and streets attracting the wealthier, thereby benefiting the overall retail sales and drawing economic advantage to the area (Sermons and Seredich, 2001; Hass-Klau, 1993). Pedestrianisation also encourages local people to buy utilities in their own neighbourhoods and attracts more customers from a wider area, increasing the community relations (Ross, 1999; Kumar, 2005).

Poor pedestrian, cycling and transit options can harm businesses by losing the worker potential. Investment in pedestrian programs is llittle and sometimes nil. These projects often require minimal time for construction and most do not require any financial support from business owners. Litman (2004) summarised the various effects of walking in a community (see Table 1).

Table 1: Effects of walking in a community

	Description	***Criteria***	***Measuring Techniques***
Accessibility and Savings	Closeness to goods, services and activities, public transportation, cost savings	Extent that non motorised transit providing mobility for transit poor	Travel Modelling, analysis of travel options, consumer expenditure surveys
Health	Amount of active transportation and net impacts on public health	Physical exercise provided to usually inactive people	Travel and Health Surveys to determine the number of people who benefit from walking exercise
Efficient Land use	More efficient land use associated with more non motorised transportation-oriented land use patterns.	The level of car oriented infrastructure i.e. more roads or overpasses for cars	Identifying the social, economic and environmental benefits of more non motorised transportation-oriented land use
Liveability	The quality of the local environment and community interactions	Change in appeal of the implemented areas	Property values, business activities, consumer preference surveys.
Economic Development	Impact on commercial establishments and shift in consumer expenses	Change in sales in the commercial sectors and the decrease in expense for fuel and vehicle.	Market surveys and property assessments.

(Source: Litman, 2004)

Citing the above reasons it can be said that pedestrian precincts increase economic productivity, employment, business activity, investment and other kinds of economic development. Customers place high value onpedestrian environments such as retail malls, suburban office campuses and pedestrian-oriented resort communities. Pedestrianised commercial areas can be very important in increasing the liveability and friendly environments that attract residents and visitors (USEPA, 2004). Placing café seating on sidewalks widening the footpaths and increasing the greenery near the store fronts can increase the appeal and attract the pedestrian/potential customers.

According to a study of more than 100 pedestrianised cities worldwide, it was found that the turnovers in the city centres of these cities increased in 49% of the cities and remained stable in 25%. Cities in Austria, Germany and Scandinavia experienced increase in turnover of more than 60% (OECD, 1978).

There have been several studies conducted in many parts Europe and the US but very few or almost none have been done in the Asian developing cities. Hence, this study focussed on the effects of pedestrianisation on the retailing and commercial community of Bangkok. Khao San Road, a partially pedestrian street in Bangkok, was selected to investigate the effect that pedestrianisation had on the businesses and the way the business community felt since pedestrianisation. The results documented in this paper will focus on the changes in sales volumes, opinion of retailers on pedestrianisation since implementation of the project, their opinions on the existing timings and their stance on future improvement of the project. The results will help in further developing the project and also replicating the study with recommendations in the other areas of Bangkok which can help in increasing the sales of the small businesses and also enhance the liveability of the area.

Background of the study

Bangkok has a rich cultural past and is a famous tourist destination. The growing economy of the country led to an improvement in lifestyle and an increase in vehicle numbers. Areas in Bangkok are filled with noise and emissions from automobiles. Everyday in Bangkok nearly 600 new cars are added to the roads making an extra 3 kilometres of bumper-to-bumper traffic (Kenworthy, 2003).

Bangkok has a very impressive mixture of land use compared to similar western cities with high car dependency. Commercial, residential and retail facilities are usually within a walkable distance (Newman and Kenworthy, 1989). However, Bangkok's very high motor friendly infrastructure, with generous parking facilities, wide roads and flyovers act as a catalyst for increasing car dependency (Poboon, 1997).

Walking and cycling characteristics in Bangkok are very bleak with only 13% of the work trips on these modes while the other Asian countries have an average of 34% (Newman and Kenworthy, 1999). The low levels of walking and cycling are due to the safer and more pleasant conditions for car travel (Kumar, 2006). Kenworthy (2003) recommended that if priority is given to improving pedestrian and cycling conditions in Bangkok, there will be a significant shift from car to other modes. Apart from initiating a modal shift there are other affects of pedestrianisation, it can bring economic benefit to the retailers on the pedestrianised area.

Plate 1: Pedestrianised Khao San Road

As a strategy to develop pedestrian areas Bangkok Metropolitan Authority (BMA) has initiated pedestrianisation schemes in some commercial areas. One such area is the famous Khao San Road (Plate 1). It is a street located in the Banglampoo district of Bangkok (Figure 1). It is a famous destination for many local and foreign travellers and backpackers. The location is apt for backpackers as it provides cheap lodging and boarding facilities. Apart from the motels, Khao San Road has food stalls, travel agencies, souvenir and music shops. The road has been pedestrianised as part of government policy with the help of the local police station. The Tourism Authority of Thailand (TAT) helped in promoting the project. The project was implemented in the year 2001 (C Kaewumporn 2006, pers. comm., 23 February) and another reason for implementation was the increasing traffic jam on the street.

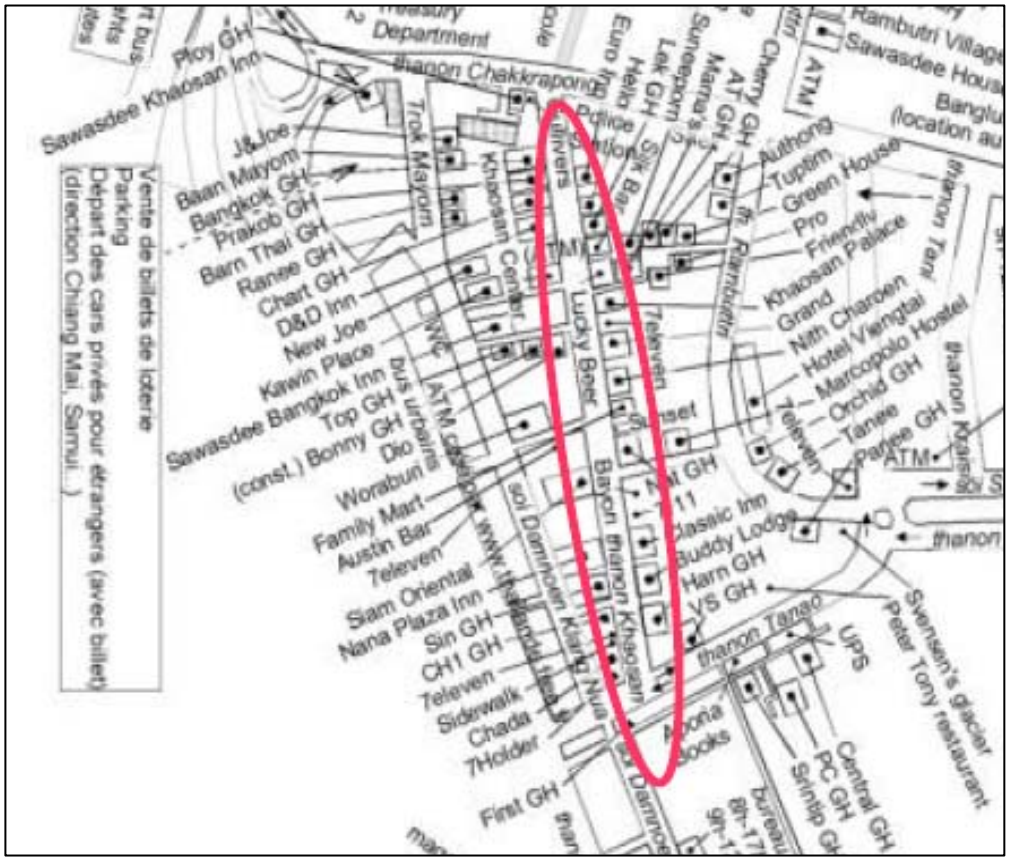

Figure 1: Map of Khao San Road

Pedestrianisation has been implemented in some areas of Bangkok but the outcomes of the projects were never studied. Hence this study attempted to fill the vacuum of the outcome of pedestrian projects. The study investigated the response of the small business owners in Khao San Road upon the effect of pedestrianisation on their business turnover and their view on

pedestrianisation before and after implementation. For this study, the businesses in Khao San road have been categorised *viz.* Restaurants, shops, guest houses, and travel agencies and samples were taken through stratified random sampling method. The data was collected by means of a questionnaire which focussed on the economic changes since pedestrianisation. The obtained results have been interpreted using SPSS 13.0.

Study site, sampling and sample size

Khao San Road in Bangkok, the study site, is a famous destination for foreign backpackers as it offers a wide range of services along with reasonably priced accommodation. The road is currently pedestrianised during specific hours of the day. During non-pedestrian hours, on-road parking is available making the street narrow. There is a high frequency of taxis and tuk-tuk's on the road. Public transport cannot be found on the road mainly due to its size, but there are bus stops near to Khao San Road which are easily accessible on foot.

Khao San Road has a wide diversity of retail shops. For this study all shops that were present before implementing pedestrianisation and after pedestrianisation have been considered. According to pre-survey results it was found that there were about 100 guest houses, 125 food stalls, 20 travel agencies and 120 shops selling music, souvenirs, and textiles.

A stratified random sampling method was used in selecting the samples. Neuman (2003) suggests that for a study with a population under 1000, the required sample size has to be more for accuracy hence a sample size of about 30% is suggested, and for a moderately larger populations (about 10,000) the sample size can be about 10% and for populations over 150,000 the sample size ratio can be 1%. For this study, the shops in Khao San road have been divided into categories (Table 2) *viz.* Restaurants, shops, guest houses, and travel agencies and the respective samples have been considered.

Table 2: Population and sample size of the study

Type of Shop	Population	Sample Size
Food stalls	125	38
Shops	120	36
Guest houses	100	30
Travel Agencies	20	06
Total	**365**	**110**

Results of the Study

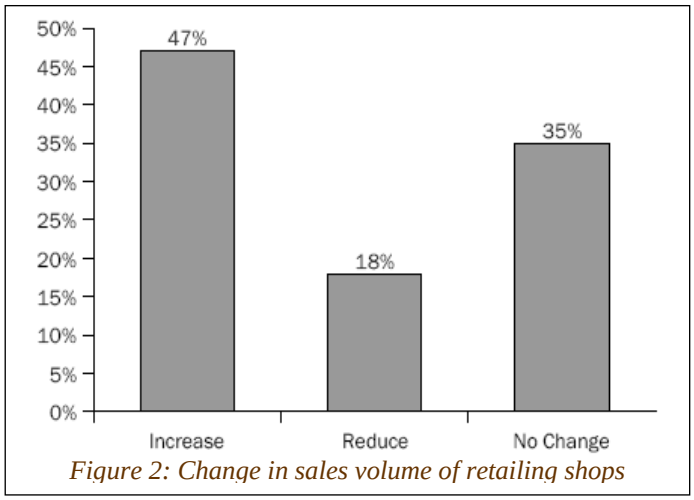

Figure 2: Change in sales volume of retailing shops

The following section discusses the results obtained from the questionnaire survey. The research was carried out during the months of September and October 2005 and mainly focussed on the changes in business activity, linking these changes to changes in the liveability of the area. Other studies (Appleyard,1981; OECD,1990; Hass-Klau,1993, Newman & Kenworthy, 1999) have shown that the implementation of traffic calming in residential areas and the pedestrianisation of retail areas will improve amenity and liveability of the affected area. For the purpose of this

research, liveability is expressed in the quality of the local environment which will act as an attractor of customers to the businesses in the area. As stated in the Table 1, the changes in sales volume and rental values were considered to be good indicators of improved business activity resulting from improved liveability. Other things being equal, improvements in these indicators can be attributed to an improvement in the local pedestrianised environment.

Changes in sales volume

Sales volume is the sales volume of a retail shop in a specified period of time. The sales volume depends on various factors such as the economic condition of the country or the area and the amount of activity in the area. The number of customers to the area is a direct factor affecting the sales volume. If the area can attract more visitors then the shops in the location will have more potential customers. Pedestrianisation tends to increase the sales volume as it attracts more visitors to the area of implementation (Plate 2). Even though the economic condition of the country is good and rising, unappealing areas don't attract visitors

Plate 2:More customers is more sales

resulting in business closures in that area (Colin Buchanan and Partners, 2001). Pedestrianisation can remedy such a situation.

In the current study the respondents were asked about the status of their sales volume. About 47% (Figure 2) of the respondents replied that their sales volume had increased, *"Sales increased after the project, people like to walk and shop..."* replied one restaurant owner, while 35% said that their sales volume had not changed, *"...my business has not changed much…because of the footpath shops.."* said a souvenir shop owner. The reason for this can be attributed to the location of the shop which was away from the mainstream pedestrian area and also because of the services the shop offered. A few guest houses in the study were located inside "*soi's*" or lanes lacking direct contact with the mainstream of the pedestrian activity. *"...the guest house is away from the main road so not much affect but the tourists have to walk with their luggage..."* said a guest house manager. It has been found that the establishments which benefited the most were the food and souvenir shops. It can be noted from the activity of the street that not only foreign tourists avail the retailing service, but also the local Thai people buy from the shops on Khao San Road.

Changes in the Property/Rental Values

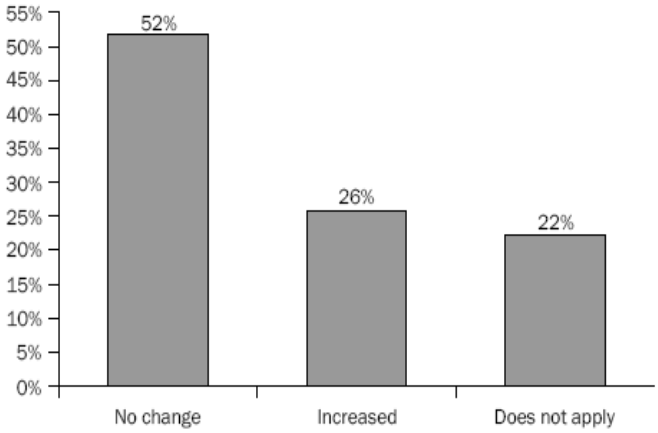

Figure 3: Change in the Rental Values

Fluctuation in rental values in a commercial area mainly depends upon the amount of business done in the area. This sub-section will discuss the results obtained on the vacillation of rental values in Khao San Road. The respondents were questioned about the changes in the rental value of their business premises. The majority of the responses (52%) (see Figure 3) expressed "no

change" in the rental value and 22% replied that the rental value factor does not apply to their business. *"I don't need to pay rent.."* replied a guest house owner. On the other hand, 26% reported that their rent had increased.

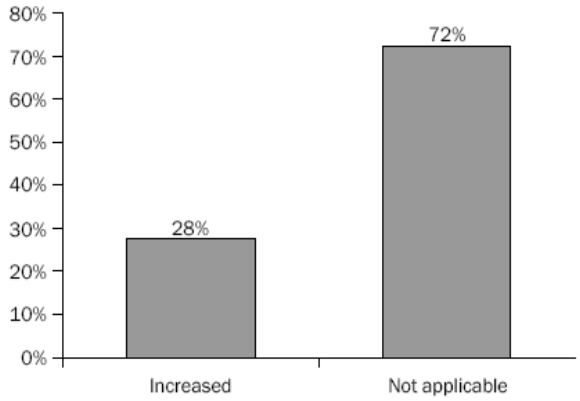

Figure 4: Revision of Rents

Similarly, the respondents were asked about the revision in the rent they pay to the owner and 28% (Figure 4) reported an increase in their rent, *"..my owner increased my rent by 2,000 baht a year back.."* replied a tenant retailer, while the majority of the respondents replied that the question was not applicable for them. The major response of "not applicable" is because the owner of the shop also operates the business. The respondents who replied that there was a change in rent were tenants. According to Thailand laws, the area of Khao San Road falls under 'royal property' and hence ownership cannot be claimed. The shops located in this area are under a long lease and the value is revised every 3 years.

The unusual replies can be explained because many of the shops were not rented but rather run by the owners; hence some of the responses were "does not apply". In most of the cases, the owners of the building did not want to increase the rents and hence there was no change in rental values. However, some of the landlords did increase the rents giving rise to the result of "increased rent". The increase in the rents ranged from as little as 1,000 baht to 2,500 baht to the existing rent. The latest period of increase in rent noted was for the previous 3 months and the maximum period was for the 3 previous years.

However, the changes in sales volumes discussed earlier clearly state that there as been a positive change after pedestrianisation. The sales volume has not decreased greatly but has either remained constant or has increased.

Opinion of retailers on pedestrianisation

Pedestrianising a street requires stakeholder agreement and in many cases pedestrianisation projects fail if there is a vacuum in the consultation process among the stakeholders, such as the retailers, the police, and municipal authorities. If there is strong approval from the stakeholders, the project is more likely to be successful. In this study the retailers have been asked about their opinion on pedestrianisation of Khao San Road.

The study found that before implementation, a majority of the retailers (Figure 5) believed that pedestrianisation could not improve the existing condition and were indifferent to the project. A retailer replied *"why pedestrianise the street? farang (foreigners) like to come in a car".* It was also found that 30% disagreed with the idea, as they believed that pedestrianisation would bring negative effects to their business (the removal of cars from the street would also remove their customers) and disagreed to the project idea; *"...traffic jams are good for the business....people watch my shop when they are stuck in the jam..."* replied a tailor shop owner. Among the retailers 20% were optimistic and felt that the changes pedestrianisation would bring to their business would be positive and agreed to the project implementation. *"...remove the cars and the customers will increase..."* replied a restaurant manager.

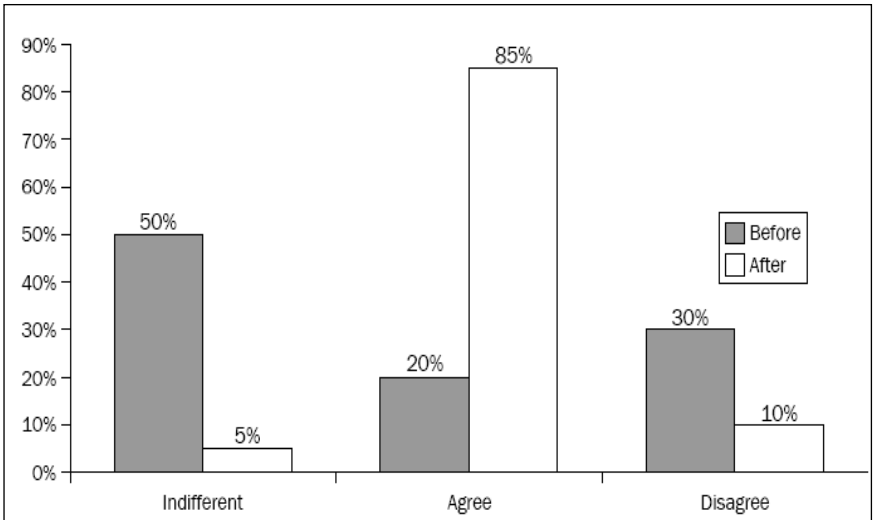

Figure 5: Opinion of retailers on pedestrianisation project

Since pedestrianisation, the majority of the retailers (85%) have agreed with the project while the retailers who disagreed decreased to just 10%, *"..I think no cars means more customers, now even Thais come and drink..."* replied a pub owner. It has to be noted that the results obtained are in accord with the general psychological tendency of retailers around the world. In other places of pedestrianisation there are records showing that initially there was a protest against the project but after implementing there were requests from other businessmen to implement the project in their areas. The number of retailers who still disagree with the project (10%) is related to the kind of business they hold. In the case of travel agents, the project might not be effective as the customer evaluates the quality of service the agents provide rather than the accessibility to the agency itself.

Opinion of the current pedestrian timings and stance on further pedestrianisation

Khao San Road is pedestrianised from 6pm to 3am. Partially pedestrianising a street in many cases will not allow the full potential of pedestrianisation to be utilised. Partial pedestrianisation also restricts other traffic calming benefits, such as increased liveability and street appeal, as during the day the street is just like other ordinary streets with cars.

This study has questioned the respondents regarding their opinion on the current pedestrian timing and the results are explained below. The results from the study revealed that 74% of the respondents agree or strongly agree to the current pedestrian timings and required no change in them (darkened portion of Figure 6). *"A perfect and classic project"* replied a retailer, while another said *"…commercial areas can benefit with this project. My sales increased…."* While 13% of the respondents reported that they disagreed to the current timing, (among whom 5% disagreed or strongly disagreed with the timings and recommended an increase of the timings to be longer), the rest of the 8% disagreed or strongly disagreed and recommended a decrease in the current timings; *"very hard to walk on the street for long distance, should reduce timings for visitors convenience."* replied a guest house owner.

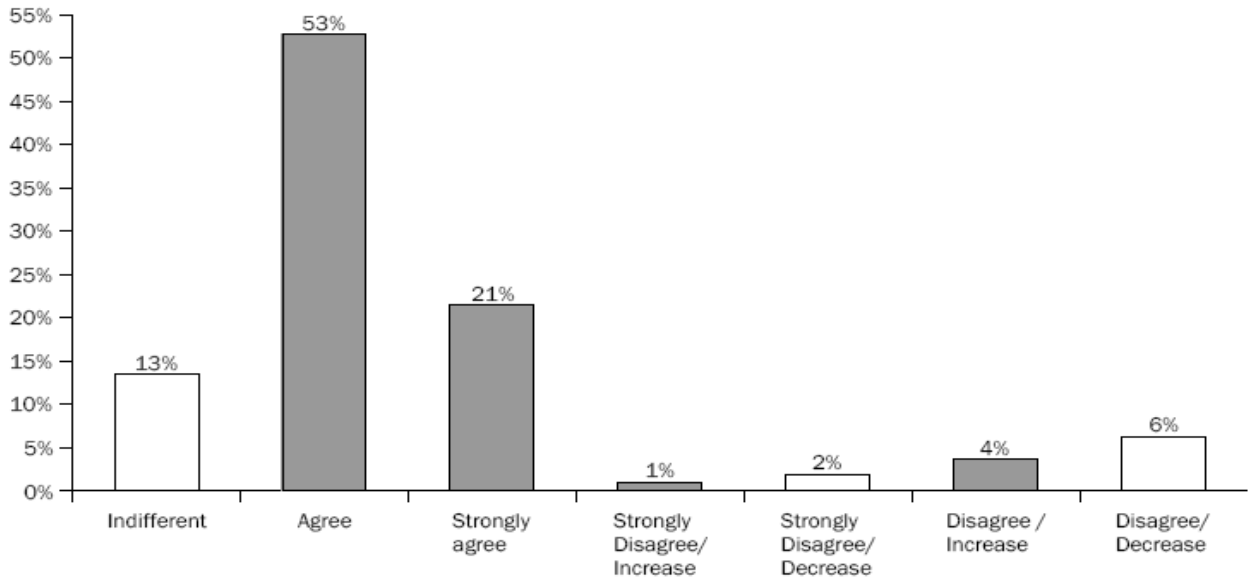

Figure 6: Opinion on the current pedestrian timings

The respondents were also questioned on their proclivity towards further pedestrianising the street and implementing other traffic calming measures. Forty-four percent responded that they will not participate while 41% (Figure 7) showed support for the improvement. One retailer said *"Sure my support is there, it increases the sales and also wide variety of things to buy"* (Plate 4). As with every project there were also people (15%) who said they will oppose the idea, *"I will not support it if the garbage condition is worse like now…."* said a retailer. The opposition can be reduced with proper awareness among the stakeholders.

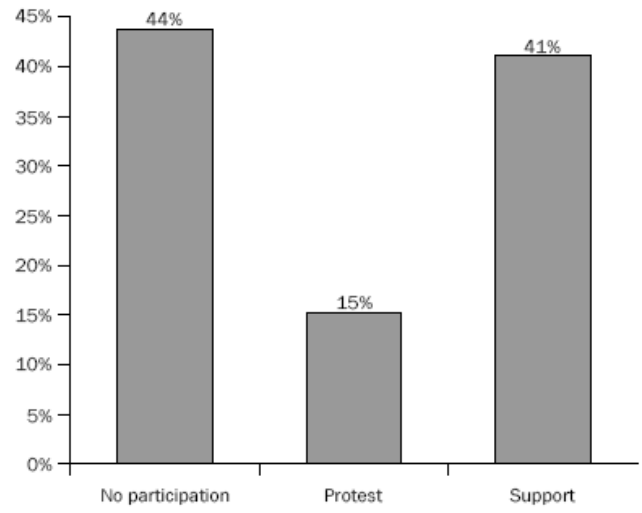

Figure 7: Stance on further pedestrianisation

Conclusion

Earlier studies found that the implementation of traffic calming measures, including pedestrianisation, will reduce traffic speeds and accidents and thus make the streets safer and more pleasant places to be. The current study, conducted in Khao San Rd, Bangkok, Thailand, has shown that traffic calming can also have a positive economic benefit for the retailing and commercial community by increasing sales volumes. Furthermore, as indicated by increased property/rental values and business activity as well as by the preference of consumers as expressed in surveys, the liveability of the area is also improved. The current study also found that retailers were positively inclined towards further pedestrianisation in the area.

It is also suggested that while implementing the project, sufficient care must be taken in providing enough garbage disposal facilities and efficient collection measures so that as visitor numbers increase the appeal of the road will not be diminished by litter.

This study has shown that the argument often put forward by retailers that their customers need car access (presumably in order to carry the goods home), is simply not correct. While retailers in Khao San Rd were initially sceptical of the pedestrianisation project, few were opposed to extending the project once they had experienced its benefits. In a city as dominated by cars as Bangkok, Khao San Rd has become an oasis for both foreigners and Thai people seeking refuge from the noise, dangers and pollution of cars.

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Address for correspondence:
sunnysanthosh@gmail.com

Questionnaire for studying the impact of pedestrianisation on the business owners in Khao San Road

Date of Interview : _____ Business Type: FS/SH/GH/TA (FS: Food stall, SH: Ordinary Shop, GH Guest House, TA travel agency)

Number of years doing the business in KSR: _____

1. What was your opinion when the project was proposed? Did you think there will be an impact on the business because of pedestrianisation: Yes / No
   Please explain _____

2. What were the opinions of your co-businessmen in Khao San Road about pedestrianisation at the time of implementation? _____

3. In your opinion do you feel that the footpath shops are an obstacle for your business: Yes / No / Does not concern

4. Do you derive any benefit from the footpath shops: Yes / No.
   Please explain _____

Effect on Economic Variables

5. What is your opinion on the following after applying pedestrianisation?

		Increase	Reduce	No Change
i.	Change is sales volumes	□	□	□
ii.	Change in the rental/property values	□	□	□

6. When was the last time that your rent was revised? _____ (Increased/Decreased)

7. What is your opinion on the current pedestrian timings in Khao San Road?
   □ Strongly Agree □ Agree □ Indifferent
   □ Disagree (Increase / Decrease)
   □ Strongly Disagree (Increase / Decrease)

8. What role will you play if more pedestrian friendly measures are implemented in Khao San Road and the nearby areas?
   □ Support □ Protest □ will not participate

9. What will be your recommendation to other commercial areas in Bangkok in regard to pedestrianisation? _____

10. Any other comments or suggestions:

Cycling for active transport and recreation in Australia: Status review and future directions

Rissel C, Garrard J

Introduction

An important priority for health promotion in the 21st century is increasing the levels of physical activity for whole populations. Physical inactivity is the second (after tobacco smoking) most important behavioural cause of ill-health in society (AIHW, 1999). The majority of adult Australians are not physically active at the level recommended to achieve health benefits (AIHW, 2004). Physical inactivity is a major modifiable risk factor for cardiovascular disease (CVD) and independently affects other CVD risk factors such as type II diabetes, total blood-cholesterol level, obesity and hypertension (USDHH, 1999; Bauman and Owen 1998).

The energy expenditure to achieve population level increases in physical activity levels is most likely to be sustained if incorporated into daily routines. Therefore, the concept of 'active transport' is an important one. The term 'active transport' relates to physical activity undertaken as a means of transport (Davis, 1999). This includes travel by foot, bicycle and other non-motorised vehicles (Mason, 2000). Among the three major active transport modes (ie public transport, walking and cycling), cycling is currently the least used in Australia, although all three have the potential for substantial increases (Austroads, 2005).

In Australian state capitals, the proportion of trips taken by bicycle ranges from one to five per cent, while the proportion of Australians owning bicycles ranges from 30-65 per cent (Australian Bicycle Council, 2004). In many European cities the proportion of trips taken by bicycle is over 25 per cent of all trips (ADONIS, 1998). Over half (55%) of car trips in Sydney and other capitals are less than five kilometres and 33 per cent are less than three kilometres (NSW Department of Transport, 1995), distances considered easily amenable to cycling.

While there are many European examples of policy and practice that have contributed to increases in levels of cycling (Pucher and Dijkstra, 2003), there is very little Australian research to provide evidence to policy makers on effective interventions to promote cycling. The purpose of this paper is to review all the published and as much of the unpublished 'grey' Australian literature that could be found that addresses the promotion of cycling, and that has an evaluation component that allows the identification of effective interventions or factors that influence population levels of cycling.

Method

The electronic data-bases MEDLINE, PUBMED, and APAIS were searched for the years 1995-2005 using the terms "cycling", "cyclist", "cycl*" and "bicycles". The Google internet search engine was

used to help locate possible reports or papers that described the evaluation of interventions to promote cycling. Further, the authors contacted all major Australian cycling organisations or persons active in the promotion of cycling in Australia to identify unpublished evaluation reports of cycling promotion programs.

Papers or reports that focused on the health benefits of cycling were excluded, as this has been internationally well researched with unequivocal results of the positive health benefits (see for example papers or articles by Paffenberger et al (1986), Roberts et al (1996), Anderson et al (2000), Hu et al (2003), and Steindorf et al 2003)). Papers dealing with the use of bicycle helmets and injury issues were also excluded, even though the mandatory wearing of helmets in Australia may adversely influence population frequency of cycling (Jacobsen, 2003; Robinson, 2005) by acting as a general, albeit small deterrent to everyday or casual cycling. While safety concerns directly impact on population levels of cycling, the injury prevention literature is distinct from that of cycling promotion, and is not included in this review.

Physiological focused papers on athletic performance represented more than half of the articles retrieved from the literature search. However, articles dealing with competitive sport and elite cycling were also excluded, as this area of cycling is quite specialised and restricted to a relatively small proportion of the population. There is much greater potential for population-wide participation in cycling and physical activity through a focus on cycling for transport and recreation.

Cycling prevalence in Australia

Limited data on cycling prevalence in Australia are available from the national census (every five years), transport surveys, and special purpose studies. Data have been collected in the transport, health, sport, recreation and tourism sectors, often using inconsistent measures. This review focuses on data related to cycling for transport and recreation. These are described separately, though in some studies no distinction is made between these two forms of cycling.

Cycling as a means of transport

Unlike other modes of transport, data on cycling as a means of transport is poor. National population census data are available for journey to work only, which represents travel on only one day in the middle of the Australian winter. Travel surveys that include all forms of cycling for transport have been conducted in a limited number of Australian states, cities or regions. No consistent national data are available.

In the 2001 Australian Census of Population and Housing, 0.94% of employed persons aged 15 years and over travelled to work by bicycle (Bell, Garrard and Swinbourne, in press). There was a marked gender difference, with 0.40% of women cycling to work, compared with 1.39% of men (Bell, Garrard and Swinbourne, in press). Cycling prevalence was highest in the Northern Territory for men (4.19%) and women (2.37%), followed by the Australian Capital Territory (2.70% and 0.96% respectively). Cycling prevalence was highest in the youngest age groups (15-24 years and 25-34 years) and declined thereafter with age, except for a small increase in the 75 and older age group). Cycling prevalence declined for

men (from 1.45% to 1.39%) from 1996 to 2001 and increased marginally for women (0.37% to 0.40%).

The 1996 and 2001 censuses were collected on a single day in August (the middle of the Australian winter). Wet weather and limited daylight hours can adversely influence a person's decision to cycle to work. The Victorian Activity and Travel Survey for the period 1997 to 1999 indicated up to 30% more cycling trips undertaken in autumn than in winter (VicRoads, 2004). Therefore, the above cycling prevalence data underestimates the yearly prevalence of cycling to work in Australia.

The Victorian Activity and Travel Survey (VATS) is an example of a survey that measures all travel by all modes by all people in the surveyed households (McGinley, 2003). While it records all bicycle trips (and not just journey to work), the sample of 14,874 households with 30,464 household occupants (comprising 770 individuals, 2.52%, who reported using a bicycle on their allocated travel day) is drawn only from metropolitan Melbourne. This does suggest that the prevalence of cycling is higher in urban areas compared with rural areas.

For the data collection period 1997 to 1999 in the VATS, approximately 75% of cyclists are male, and 49% are less than 20 years old (mainly in the 10-20 years age group). On average, 1.2% of all trips in Melbourne are by bicycle, more than by bus (1%) or tram (1%). The average number of bicycle trips is 0.07 trips per person per day, although this varies by locality, with cycling for transport decreasing from 3.7% of trips in central Melbourne to 1.3% in the inner suburbs to 1.0% in the outer suburbs to 0.9% in outer metropolitan regions of Melbourne. A higher percentage of bicycle trips are made on weekends than on weekdays. The majority of bicycle trips are up to 1 km in length (36%) and nearly 90% of bicycle trips are 5 km or less. Cycling to work accounts for the highest proportion of all bicycle trips (14%). It should be noted that the VATS survey data include bicycle trips undertaken for recreational purposes.

In a survey of physical activity levels of South Australian adults conducted in 2004 by the South Australian Department of Health, 8.5% of respondents reported cycling at least once a week (Gill and Taylor, 2005). Almost five per cent (4.8%) of respondents had cycled for at least 10 minutes for recreation only in the past week, 1.6% had cycled for transport only, and 1.4% for both recreation and transport.

In metropolitan Sydney in 1998, one percent of the population cycles everyday, which represents 91,000 bicycle trips each week day (Transport Data Centre, 2003). However, there are marked regional differences, with some inner Sydney areas seeing 2-3% of journeys to work, and outer suburbs seeing less that 1% (Telfer and Rissel, 2003). There has been a 64% increase in cycling to work in the inner Sydney areas between the 1996 and 2001 censuses (Telfer, 2003). In 1998, the majority of Sydney riders (58%) were male (Transport Data Centre, 2003).

Cycling for recreation

Annual surveys of participation of Australians aged 15 years and over in exercise, recreation and sport have been conducted by the Australian Sports Commission from 2001 to 2004 (Australian Sports Commission 2005). Cycling, with a participation rate of 10.5% in 2004, is the fourth most

popular activity after walking (39%), aerobics/fitness (17.1%) and swimming (16.5%). Participation in cycling increased by 15.3% from 2001 to 2004 (Australian Sports Commission 2005).

Participation in recreational cycling events

State-based bicycle advocacy organisations conduct a range of single-day rides and multi-day bicycle tours. Analysis of the ride participant database of the largest and most active of these organisations, Bicycle Victoria (BV), reveals that there were 208,244 participants in eight BV-organised rides and tours from 1994 to 2004 (Garrard and Crawford, 2005).[26] Overall, participation in BV rides increased by an average of 10.8% per annum from 1994 to 2004, with much of this increase occurring between 2001 and 2004.

Gender differences in the shorter distance recreational cycling events are generally not as great as for cycling for transport, averaging about 30% across all rides. The longer recreational cycling events attract relatively fewer female participants, with the 210 km Victorian 'Around the Bay in a Day' ride comprising 12% females (Garrard and Crawford, 2005).

Influences on cycling

Demographic influences on cycling in Australia include age, gender, socio-economic status and location. The highest level of recreational cycling (at least once in the past year) occurs in those aged 25-34 years, and declines steadily with older age (Australian Bicycle Council, 2004). The age distribution of participants in cycling events organised by Bicycle Victoria shows a slightly older age distribution though comparisons are made more difficult due to the use of different age ranges (Garrard and Crawford, 2005). This could reflect age differences in frequency of cycling (most event participants train in preparation for rides and are therefore likely to cycle more than once a year); real age differences in participation in organised events compared with recreational cycling, or the possibility of differences between Victoria and the rest of Australia. The Australian Bureau of Statistics journey to work data indicates that cycling for transport (national census data) has high levels of participation among people aged 15-24 years that is similar to that of people aged 25-34 years, and shows a similar decline with age as for recreational cycling (Bell, Garrard and Swinbourne, in press).

There are substantial gender differences in cycling in Australia. The female rate of Australian commuter cycling is less than one third that of the male rate, and similar gender differences occur for recreational cycling (Garrard, 2003). In contrast, in several western European countries commuting cycling rates are high, and women cycle more frequently than men (Garrard, 2003). In Australia, women cycle shorter distances than men and have a stronger preference for cycling on bicycle paths, which provide separation from motor vehicles (Garrard et al, personal communication). Female cyclists' income distribution is similar to the general Victorian population, but male cyclists are more likely to be in lower and higher income groups (Garrard et al, personal communication).

Barriers to cycling

Of the approximately 40-50 per cent of the Australian population that have access to a bicycle and are healthy enough to ride one, and looking at those

trips where using a bicycle is feasible, there are different influences on cycling dependent on individual current cycling behaviour. For example, for persons not currently riding a bike, or not having done so for several years, then the barriers and motivations to cycle are different compared with someone who is a current recreational rider, or a regular cycle commuter. It is worth identifying three main groups here: non-riders, occasional riders, and then commuter cyclist and regular recreational riders. There are other groups of people involved in competitive cycling, such as road-racing or technical mountain bike riding, and touring cyclists, but these people have separate and specific barriers and motivations.

The following table considers those factors that influence people who cycle for recreation and for transport. These influences are grouped by whether they are individual, social, cultural or economic factors, and environmental factors. Sometimes the same variable can have one dimension that is a barrier, and yet may also be a motivating factor. For example, for a non-cyclist getting fit/healthy can be a significant reason to start riding, but at the same time the lack of fitness can make starting to ride an effort and the perception that cycling takes great effort serves as a barrier.

Safety concerns, often arising from the speed and volume of traffic and not having designated space for people riding bicycles, and aggressive driving has been consistently identified as deterrents to regular cycling (Greig, 2001). It is worth noting that concerns about safety are higher among non-cyclists than regular riders (Rissel et al, 2002), with non-cyclists consistently overestimating the level of risk involved. People with varying levels of cycling experience perceive traffic safety differently. Based on qualitative research with women, Garrard (2003) suggests that this it is more to do with skills, self-confidence, experience and route familiarity – when these increase, traffic safety concerns decrease.

Table 1: Influences on cycling

Influences	Includes	Specific factors	
		Recreation	Transport
Individual factors	Demographic	Age, gender, health status, SES	Age, gender, health status, distance, SES
	Personal: motivation/initiation	Health, fitness, other people, campaigns, events, information, skills, resources, challenge, social encouragement, support to address safety concerns, time availability/priority	Cost, convenience, health, fitness, incentives, environmental concerns, other people, support to address safety concerns, time availability
	Personal: maintenance	Fun, enjoyment, self-efficacy, achieve cycling goals, acquire skills,	Above, plus, establishing a routine that works (eg safe

		experience, community links (eg cycling groups) Sense of control over safety	route, carrying things, change facilities, bike security), sense of control over safety
Social/ cultural/ economic factors		Family/social 'time together' Values (eg encouraging children to be active) Cost (relatively low, but requires bike and helmet)	Normative transport behaviour Driver behaviour 'Invisible infrastructure' (eg traffic calming) Cost and convenience of alternatives (eg cost of petrol) Population density Destinations of interest
Environmental factors	Natural environment Built environment	Easy access to pleasant surroundings, geography Cycling facilities (off-road paths), amenities	Weather, geography On and off-road paths, urban design, end-of-trip facilities

Greig (2001) identified a number of predisposing factors that negatively impact on cycling. These are important to identify, in order that strategies can be developed that address them. These negative predisposing factors are the belief that cycling is dangerous, the perception that great effort is required, the reaction to compulsory helmet wearing, limited secure storage, not being aware of improved cycle ways, or the perception that cycling is something you do before you start driving. The fitness image of cyclists (for example, athletes or wearing lycra) can also be a barrier to those people who do not currently cycle.

The degree of effort required to get to a cycle path is also related to whether a cycle path is used. In a study in Western Sydney, those people who owned a bicycle and were living close to a cycle path were more likely to use it than bicycle owners living 1.5 kilometres from the path (Merom et al, 2003).

Australian Interventions to promote cycling

Seventeen Australian programs with a component to increase cycling published since 1995 with an evaluation component have been included in Table 2 below. The program title and first author and year of publication is given, followed by a brief summary of the main strategies used and results found. An assessment of the level of evidence provided by the evaluation is given according to the following hierarchy of evidence:

I Evidence obtained from a systematic review of all randomised control trials (RCT)

II Evidence obtained from at least one properly designed RCT

III-1 Evidence obtained from well-designed pseudo-RCT (alternative allocation or some other method)

III-2 Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies), Case control studies or interrupted time series with a control group

III-3 Evidence obtained from comparative studies with historical control, two or more single arm studies or interrupted time series without a parallel control group

IV Evidence obtained from case series, either post-test or pre test and post test

This hierarchy of study designs (commonly referred to as "levels of evidence") is used by the National Health and Medical Research Council (NHMRC, 2000) to indicate the increasing potential for bias in those studies on lower levels, and therefore the greater reliance on the conclusions from those higher rated studies. However, it is also important to recognise that this hierarchy disadvantages research study designs where the subject of interest is communities, policies, or local governments or other complex social phenomenon. It is very expensive to randomly allocate whole local government areas to treatment and control conditions and community interventions are relatively rare in the public health literature. It is also important to note that in some public health settings it may only be feasible, or politically and/or ethically acceptable to conduct observational studies (Rychetnik and Frommer, 2004). Evaluation opportunities that arise through policy or infrastructure changes can create natural experiments that can provide relevant and useful 'real life' data (Petticrew et al, 2005).

There are certainly more programs seeking to promote cycling in Australia than are reported here, although many of these are not being formally evaluated or the results of evaluations that have been conducted have not been documented, or the documentation of these evaluations are not readily accessible to external agencies. The level of evidence of the effectiveness of the various strategies to promote cycling provided by the available published reports is relatively low, consistent with previous international reviews (Ogilvie et al, 2004). However, this is more a reflection of the inadequacies of the traditional bio-medical evidence hierarchy in assessing the types of interventions needed to promote cycling in a variety of settings. Almost all of the identified cycling promotion program evaluations have shown some degree of increase in cycling, suggesting that if they were to be implemented on a wider scale and with adequate resources they would lead to increases in population levels of regular cycling.

Discussion

This review has highlighted the relatively low level of regular cycling for transport in Australia, and the marked gender disparity of riders. However, cycling is a very popular recreational activity (fourth most popular nationally), suggesting that under favourable conditions some of these riders could substitute short car trips for bicycle trips. This review has also highlighted the variety of personal, social and environmental influences on cycling, which are more or less influential depending on where on the continuum of cycling development a person might be.

Achievable cycling targets

In thinking about the factors that influence people to ride a bicycle, it is important to remember that even in those European cities where cycling is a common mode of transport, the highest proportion of trips by bicycle is around 45 per cent of all trips (Anderson 2005). There are some circumstances where using a bicycle is not an option. First, there is a time/distance barrier for a journey, beyond which it is not an option to use a bicycle. While this point will vary depending on the level of cycling enthusiasm, between 30-60 minutes is a general limit for the majority of the population.

Second, certain commitments will impact on the ability to use a bicycle. For example, carrying heavy or bulky items reduces the feasibility of cycling, as do other choices, such as walking to school with a child or taking an elderly relative shopping which then intrudes on the time/distance barrier.

Third, a certain proportion (10%) of the population will be physically unable to ride a bike because of a physical disability – between 5.2% (severe or profound core activity restriction) to 15.3% (one or more activity limitations or restrictions or participation restrictions), and this increases in older populations(AIHW, 2003). Lack of physical fitness or even adequate physical activity affects almost half the population, which reduces the time/distance able to be cycled.

Finally, not having access to a bicycle is a critical determinant of cycling behaviour. Approximately 40 per cent (39%) of Sydney households have access to a bicycle (Transport Data Centre, 2003). with Sydney having the lowest level of bicycle ownership in Australia at 29 per cent, compared with bicycle ownership in Canberra at 65 per cent (Australian Bicycle Council, 2004).

Recommendations for research and practice

This review has highlighted the relative paucity of research and evaluation studies concerned with the promotion of cycling. Given the lack of evaluation data, there are many aspects of cycling that require research and evaluation. The main areas of work identified in our review are summarised below, but these are not intended to be comprehensive.

- Implement and evaluate advocacy strategies to increase political commitment and will to support cycling, and increase the profile of everyday cycling among policy and decision makers;
- Regular and systematic national and state assessment of cycling frequency and prevalence, such as outlined in the Cycling Data and Indicator Guidelines (Australian Bicycle Council, 2000);
- Document/evaluate the effects of 'invisible' infrastructure on cycling prevalence and safety, such as lower speed limits and traffic calming;
- Document/evaluate the effects of off- and on-road cycling infrastructure, and its promotion;
- Better access to documents / understanding of the individual, normative, and social factors that facilitate or hinder cycling;
- Better understanding and documentation of the role of 'road rage', poor driver behaviour and 'safety concerns' on cycling prevalence;
- Research to explore whether increases in cycling leads to overall

increases in levels of physical activity;
- Clearinghouse role for the Australian Bicycle Council (or similar) for reports on cycling and evaluations of strategies to promote cycling; and
- Bicycle advocates/researchers need to document better the effective strategies for promoting cycling.

Conclusions

From the published evaluation studies located, it is clear that there are very few high quality Australian evaluations as defined by biomedical research standards, although the number of such reports and publications have increased substantially in the last five years. Despite this lack of evidence, there has been a small but sustained increase in the prevalence of cycling over recent years, particularly in the inner state capital city areas. There are many examples of small projects that have increased cycling, or improved the conditions for cycling, and many examples from other countries. The absence of control groups is not necessarily an evaluation limitation, as the prevailing cycling trends are declines or no change. The best available evidence indicates that the investment in cycling infrastructure AND promotion successfully encourages cycling. It is also clear from data on frequency of recreational cycling that a great many people want to ride bicycles. However, despite the multiple benefits of cycling across many sectors, political support and financial commitment to cycling are required to increase the prevalence of cycling.

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Address for correspondence:
Chris Rissel
Health Promotion Service
Level 9 (north), King George V
Missenden Road, Camperdown NSW 2050, Australia.

Phone: (02) 9515-9055
Fax: (02) 9515-9056
Email: criss@email.cs.nsw.gov.au

Table 2: Australian interventions to promote cycling by setting and intervention type

Intervention type	Setting / population			
	School	**University**	**Workplace**	**Community-wide**
Education / skills	Bike Education program *(Carlin, Taylor and Nolan, 1998)* Strategy: School based curriculum program with skills component. Results: Increase in injuries in the intervention group Evidence level: III-2			Adult skills group *(Telfer et al, in press)* Strategy: 6 hours of group instruction, mostly learning cycling skills and ride practice Results: An 40% increase in weekly cycling time among those not-riding at baseline Evidence level: III-3
	CARES program *(Baker, 2005)* Strategy: Purpose built training venue for skills development, plus classroom component Results: Decrease in injuries in intervention group (12% v 22%) Evidence level: III-2			
Social marketing / behaviour change		Monash Travel Smart *(Cooper and Meiklejohn, 2003)* Strategies: Travel behaviour change media promotion among students Results: Observed increases in cycling Evidence level: III-3	Health workforce intervention *(Wen et al, 2005)* Strategies: Individual travel behaviour change interviews with a cohort of staff, plus general social marketing strategies Results: Reduced car use, but no change in cycling level Evidence level: III-3	Adelaide project (Rose and Ampt, 2001) Strategies: individual action program, known as Travel Blending®, involves participating households being sent a series of four kits, containing information booklets and travel diaries, over a nine-week period Results: a 10% reduction in car driver kilometres Evidence level: III-3
			Ride to Work Day *(Marfut et al, 2005)* Strategies: Ride to work event advertised widely through workplaces Results: 13% rode to work for	Event series data analysis *(Garrard and Crawford, 2005)* Strategies: Secondary data analysis Results: Increase in event participation over time

			the first time, and a quarter of these people were still riding to work five months later Evidence level: III-3	Evidence level: IV
				Hawthorne Canal Project *(Ashley and Rissel, 2004)* Strategies: Distribution and promotion of local cycling map illustrating key connections, plus organised community rides Results: Bicycle counters indicated an increase in use of highlighted route Evidence level: III-3
				Bike event days *(Zaccari, 2004)* Strategies: Bike days organised by local council, including a family ride Results: Similar level of participation each year Evidence level: IV
Infrastructure				Cycle monitoring in Victoria *(Bicycle Victoria, 2003)* Strategies: Data analysis of bicycle counters at key strategic routes Results: Steady increase in bike counts Evidence level: III-3
				Western Sydney Rail Trail Evaluation *(Merom et al, 2003)* Strategies: Completion of new dedicated bicycle infrastructure, but minimal promotion Results: Small but statistically significant increase in use of facility Evidence level: III-2
'Invisible infrastructure' (eg traffic calming policies, fiscal policies such as congestion taxes, petrol prices)	No Australian data			

Multi-component			Cycling 100 *(Marshall, 2001)* Strategies: Employees committed to replacing 4 car trips per week by bicycle and were given use of a free bicycle Results: Significant improvements in a range of health indicators Evidence level: III-3	Cycle Instead program *(Greig, 2001)* Strategies: Media and community intervention Results: Significant increase in the proportion of respondents who had cycled in the previous six months (28% vs 36%) plus bike counters showed an overall increase of 68.2% of cyclists. Evidence level: III-3
			Cycling in the city *(Kuiper, 2005)* Strategies: Employees at three workplaces committed to riding to work on two days a week were given cycling skills training and social supportuse within the workplace. Results: Increase in employees regularly riding Evidence level: III-3	Cycle Instead Shepparton *(Bicycle Victoria, 2004)* Strategies: Media and community campaign over two months Results: 39% increase in cycling after two months Evidence level: III-3
				TravelSmart South Perth *(James, 2002; Ashton-Graham, 2002; Department of Infrastructure, 2003)* Strategies: In-depth interviews with households about travel behaviour change Results: 61% increase in cycle trips Evidence level: III-2

Travel in Inner City versus Urban Fringe of Adelaide:

The Role of Neighbourhood Design

A Soltani, A Allan, S Somenahalli, F Primerano

Obesity, greenhouse gas emissions, and oil dependence are major concerns of sustainability in Australian society1. One factor is the increasing share of private vehicle using contributes to these problems. Another factor is suburban development, widely criticized for its contribution to longer average trip lengths and excessive dependence on private vehicles at the expense of public transport and non-motorized modes. Accordingly, for instance, a ''Liveable Neighbourhoods'' approach (The Western Australian Planning Commission 1997) to planning has been proposed as a counter to urban sprawl.

There is considerable current interest in the effects of urban design and land use characteristics on the transport choices made by people everyday. The underlying assumption is that residential neighbourhood characteristics have an important influence on a person's willingness to make a trip by transit, ridesharing, bicycling, or walking - modes other than driving alone. Further, the amount and direction of other travel behaviour issues such as the frequency of travel, and the distance travelled should be a function of surrounding neighbourhood characteristics, thus that the combination of neighbourhood characteristics and travel demand

[1] Australia is now equal second with the UK, behind only the United States, when it comes to the proportion of obese people in the population Knox , S. (2003). "Planning as a Public Health Issue." Urban Policy and Research **21**(No. 4): 317–319.. Also, Australia has higher greenhouse gas emissions per capita than any other developed country. Turton, H. and C. Hamilton (August 2002). Updating per capita emissions for ndustrialised countries, The Australia Institute.

management strategies can have a positive interactive effect in influencing travel patterns.

This study investigates travel pattern in both inner city and urban fringe households from four decisively selected suburbs to discover the potential impacts of neighbourhood design on travel choices. For this purpose, an integrated database of land use characteristics and travel activities was developed for a sample of households in the studied areas. The database was established by adding site information, developed through field observation, to the specific 2005 Household Travel Survey (HTS2005) dataset of the sample areas. The HTS2005 dataset includes information about individuals' travel, and their perception on their neighbourhood environment for a number of 321 individuals. These data were then analysed to explore the interactions that may exist between transport level of service, land use, urban design characteristics, and individual pattern of travel.

Background Studies

There is an ongoing trend to examine how urban form and land use patterns impact upon travel. This question was raised more than twenty years ago and inspired many debates so far. Review articles have also been written summarising related empirical results (Stead and Marshall 2001); (Crane 2000);(Handy 1996). However, research efforts are underway to improve modelling and assessment tools to measure the impacts of these effects. Some Australian and international examples are reviewed below:

Moriarty and Beed (Moriarty and Beed 1992) found that the expected relationship between higher density and lower per capita travel was found to apply in Australian cities in 1986, where higher-density cities had much more travel than the smaller, less dense cities. They mentioned also that despite the shortening of the separation between residential areas and activity centres, per capita travel increased greatly. They concluded that travel convenience was found to provide a better fit to the data than did land use differences.

Li, Fisher et al (Li, Fisher et al. 2005) examined the relation between built environment factors and walking activity at both the neighbourhood level and the resident level, in an older adult sample. This study resulted that there was a positive relation between built environment factors and walking activity at the neighbourhood level. At the resident level, perceptions of safety for walking and number of nearby recreational facilities were positively related to high levels of walking activity. Also a significant interaction was observed between number of street intersections and perceptions of safety from traffic. In a similar study by Giles-Corti, Broomhall et al (Giles-Corti, Broomhall et al. 2005) it was found that the likelihood of using public open spaces increased with increasing levels of access, but the effect was greater in the model that adjusted for distance, attractiveness, and size. After adjustment, those with very good access to large, attractive open spaces were 50% more likely to achieve high levels of walking. The observational study also showed that after matching open spaces for size and location, 70% of users observed visited attractive public open spaces.

With analysing the influence of personal characteristics and the attributes of the residential environment on travel behaviour in Randstad Holland Region (Dieleman, Dijet et al. 2002) it was found that both set of factors have a strong influence on modal choice and distance travelled. The characteristics of residential environment retain their impact on travel when personal factors are held constant, as the results from the multivariate analyses demonstrate. Those living in the suburbs and rural regions have to travel longer distances to work, either by car or public transport. For shopping trips, urban form plays a substantial part in the distance travelled by public transport. Those living in rural areas or suburbs travel longer distance via public transport. In fact, the two sets of factors are of about equal importance for modal choice and distance travelled, although trip purpose modifies these relationships considerably, especially for distances travelled for shopping and leisure.

Handy (Handy 1996) suggested that given motivation to walk, urban form is an external factor that can enable actual walk. A traditional walkable design encourages walking for shopping purpose, however, the newly designed suburbs can do the same if they afford retailing and stores within walkable distance. In addition, Handy showed that land use patterns affect the choice set formation of travel modes which are realistic to the trip maker: land use makes a difference in determining whether residents perceived walking as an option available to them. Frank and Pivo (Frank and Pivo 1994) found that while residential density of trip origin is an important factor in choosing a mode, employment density of destination does matter.

However, not all studies found a significant contribution of urban form features in influencing travel behaviour. A study by Crane and Crepeau (Crane and Crepeau 1998) in US, found that there is no evidence that street network impacts upon the decision of mode choice for non-work travelling. In Portland, Oregon, Hess (Hess 2001) suggested that there is an expected significant influence for parking charges on decisions to drive alone or to take alternative modes. But, there is no evidence that land use and proximity to light rail can change the modal choice decision.

Boarnet and Crane (Boarnet and Crane 2001) suggest that the environment friendly travel pattern in densely developed areas, close to or in the city centre, may well be a result of their preferences for living there. They basically welcome the opportunity that city life offers for reduced travels. That is one of the reasons why they reside there. I argue, however, this self-selection doesn't seem to change the hypothesis that neighbourhood design matters. In fact, when somebody voluntarily prefers to live in a place that induces walking and bicycling in daily life (thus subsequently avoiding using car) is a fair example of the importance and consideration of neighbourhood design. There will be no change if we assume that the residents have been unwillingly surrounded by neighbourhood facilities instead of choosing deliberately the neighbourhood.

Brunton and Brindle (Brunton and Brindle 1999) in a study of the Melbourne metropolitan area, concluded that regional accessibility to activities was

significant factors in car use, while other urban form factors have relatively little effect. If a broader range of factors is considered, the relationship between density and car using becomes weaker. They criticized the use of urban planning for addressing car dependency problems because of its frail role. They concluded that rather than take the normative position that a particular urban form must be encouraged if desired travel outcomes are to be achieved, a given city may be able to adapt to achieve the desired accessibility level in several ways. Policy may then be able to be based on setting target levels of accessibility rather than density for particular areas and land uses. The study by Brunton and Brindle (Brunton and Brindle 1999) considered aggregated attributes and measures of land use and travel, failing to consider the finer characteristics of neighbourhoods (such as provisions for various forms of travel, neighbourhood character and its conduciveness for non-motorised forms of travel), the socio-demographics of the population (such as the difference in travel patterns of individuals and households), and the type of travel being undertaken.

The study by Giles-Corti and Donovan (Giles-Corti and Donovan 2002) in Perth, found that the influence of the built environment on physical activity levels, was marginal to individual social factors and individual's characteristics. Despite this, access to open spaces and recreational facilities determined whether or not they were used. Thus, in this way, it can support and enhance the achievement of appropriate levels of physical activity behaviour. One limitation of this study is choosing a specific area which was homogeneous with less diversity within it. Also the method of analysis can be criticised due to its simple assumption on link between exogenous factors.

It sounds that the relationship between urban form and travel behaviour is more complex than it may seem on the surface. The methodological obstacles, has made it difficult to study the causal relationship. While some scholars have argued that the relationship is marginal, others suggest finding better ways to study on urban form-travel interactions (Handy 1996).

The policies that emerge from the research for directing the new development or revision of the existing situation have to be supported with relevant empirical work to be more reliable. The critique of these studies has suggested that a number of issues must be taken into account when drawing any conclusions for policy (Stead and Marshall 2001). These issues include the strength of the evidence, the transferability of findings, the scale of analysis, and the causality of relationships. Therefore, the degree to which urban form might affect travel behaviour can be lower than literature has indicated (where they have not considered socio-economics). Meanwhile, this does not mean that urban planning/design does not have a significant role to play in helping to achieve more sustainable travel patterns. Planning policies can influence transport supply as well as the distribution of land uses, and so provide a way of influencing travel demand and/or modal choice.

Methodology

Some of methodological improvements have been made in this study: using

discrete choice models to explain individual behaviour; using GIS for capturing disaggregated elements of urban form; incorporating other important factors such as household/individual preferences and attitudes; and also incorporating the overall structure of city region surrounded the neighbourhood by regional accessibility; jobs distribution and public transport infrastructure measures.

It is tried to take a disaggregated approach: in terms of urban form opertionalising, a Census Collecting District (CCD)-as defined in (Australian Bureau of Statistics (ABS) 2001)- is suggested as spatial unit of analysis. Thus all local urban form measures were taken in CCD level. For those measures with a regional impact, such as accessibility to work throughout the metropolitan region, a Traffic Analysis Zone (TAZ)-as defined in 1999 Metropolitan Adelaide Household Survey (Government of South Australia 1999) has been applied as spatial unit. In case, where a CCD was not compatible with TAZ, a weighting system was used suggested by Primerano (Primerano 2004). Using GIS facilitates work with more precision and efficiency. In case, GIS maps were not up to dated or apparent, an on-screen digitising method used to enter new features or edit current spatial features. The role of GIS for preparing data for modelling process is depicted on Figure 1.

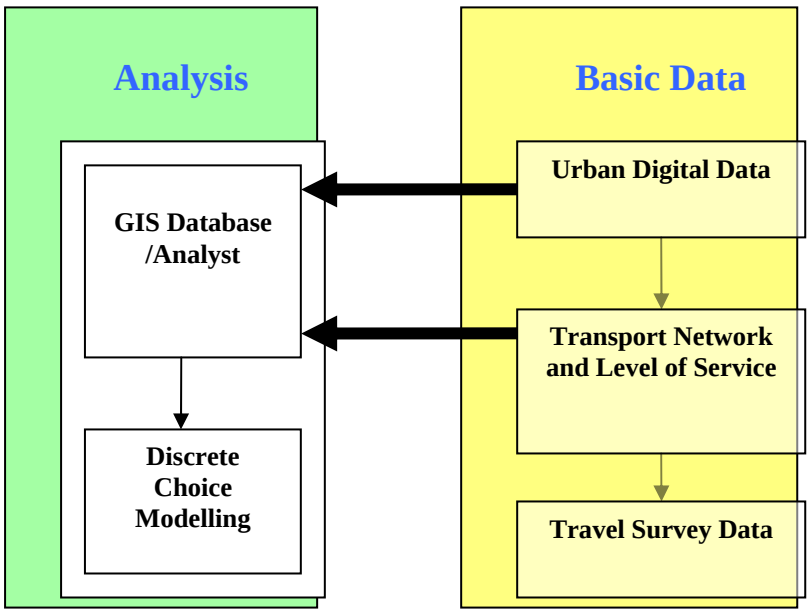

Figure 1: The role of GIS for preparing data for modeling process

The original survey consisted of 1500 addresses but only 321 valid addresses. The response rate is about 21% based on the valid returned questionnaire only. This response rate is considered quite well for a survey of this length, since the response rate for a survey administered to the general population is typically 10–40% (Sommer and Sommer 1997). A comparison of sample characteristics to population characteristics, based on the

2001 Australian Census, showed a reasonable distribution.

For modelling purpose, a set of discrete choice models was developed for modelling individual mode choices. The models were all discriminated by travel purpose and the geographic location of trip makers.

Case Study Areas

The study area includes four residential suburbs of metropolitan Adelaide: *Norwood*, *Unley*, *Golden Grove* and *Para Hills*. These four suburbs are different in terms of their physical attributes which is assumed to make a considerable difference in travel behaviour of their residents. Norwood (1853) and Unley (1871) as typical traditionally designed neighbourhoods have a mix of land uses, residential, office, shopping, civic uses, and entertainment, within easy walking distance of home. On the other hand, suburban developed areas: Golden Grove (1980s — 90s) and Para Hills (1974) lack heterogeneous land uses. The density of population and activities of these suburbs are lower than those of Norwood and Unley. The styles of housing area mostly developments of separate houses with back yards, land-escaped gardens and parking spaces, however, some developments made by South Australian Housing Trust to accommodate different social groups especially in Golden Grove (Bosman 2004).

The locations of case study areas within metropolitan Adelaide are depicted on figure 2. Some travel characteristics of the four suburbs are provided in table 1. Here are a number of facts about these areas extracted from HTS2005:

- Compared to other two suburbs, the Para Hills and Golden Grove populations are younger, which now forms the age group of 0-35, the highest age group in terms of population but the age group over 65 the lowest. This demographic difference has had its toll on transport demand market over the time.
- The areas of Norwood and Unley are characterized with relatively low car ownership compared to Golden Grove and Para Hills suburban areas. It is interesting that Para Hills has the highest figure of vehicle ownership per household: 1.6 vehicles per household. Also it has the highest percentage of households with three vehicles or more. On the other hand it has the lowest income average and highest proportion of households with income lower than $500. This primarily shows that vehicle ownership does not depend only on income level.
- All four suburbs are served properly by public metro-ticket bus as the only public mean. Meanwhile, public transport share in the studied areas is not significant.
- The average commuting distance is different for each suburb. While the residents of Norwood, Unley and Para Hills should travel about 16, 14 and 18km, the Golden Grove workers should commute significantly longer: 23km.
- The home rent throughout the four suburbs is similar: about $200 per week in average. In contrast, housing average price for Unley is highest followed by Norwood and Golden Grove which are similar together. In Para Hills, the housing price is slightly lower.
- Norwood and Unley residents have higher trip generation (for Norwood

and Unley were 3.7% and 3.5% which are higher than those of Para Hills and Golden Grove: 3.3%). The travel behaviour among the four case suburbs is markedly different, as the two outer suburbs are more car-dependent;

- Norwood has the highest share of short trips with length of less than 1 km (approximately 10%). Golden Grove has the longest trips for work (19.5 km) and non-work purposes (16.3 km).

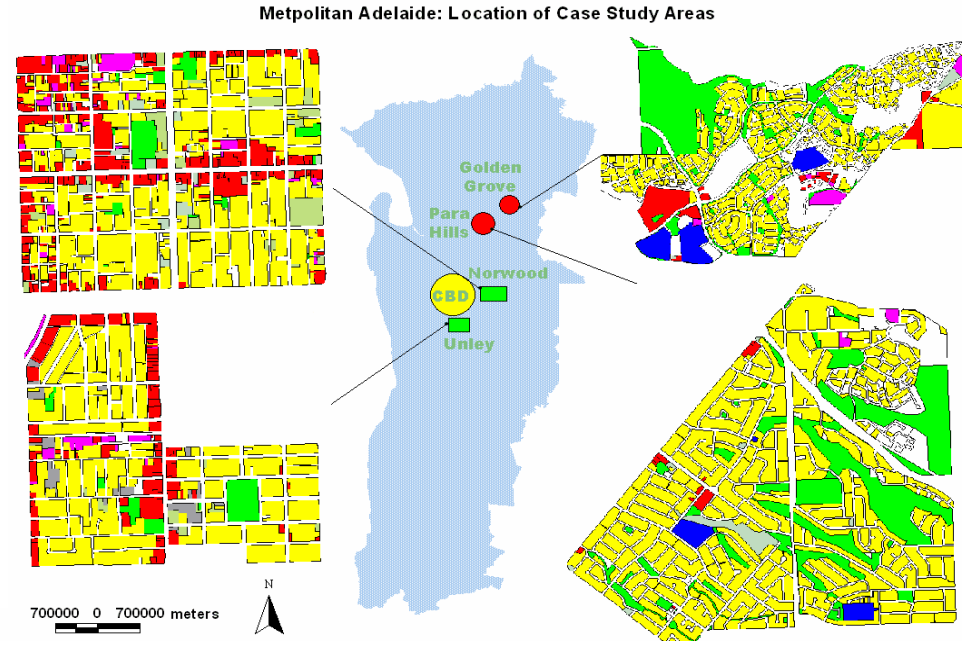

Figure 2: The Location of Four Case Studied Suburbs and Their Land Use Pattern

Table 1: Travel Characteristics for the Residents of Four Case Studied Areas

Variable Name	Norwood	Unley	Para Hills	Golden Grove
Car use share for commuting (percent)	78	76	88	91
Car use share for non-work travel (percent)	61	60	81	76
Walk/bicycle share for commuting (percent)	15	11	2	4
Walk/bicycle share for non-work (percent)	31	28	11	9
Public bus share for commuting (percent)	3	7	5	6
Public bus share for non-work (percent)	6	12	6	9
Average travel time for daily trips (min)	14	16	23	21
Average commuting distance (km)	6.7	5.8	14.6	19.5
Average travel distance for non-work (km)	5.0	5.4	11.1	16.3
Trip frequency per adult per day	3.7	3.5	3.3	3.3

Measuring urban form

A set of comparative spatial indicators were developed to quantify built environment characteristics. These measures all together represent the physical character of a residential neighbourhood and are assumed to be relatively independent from each other. Density was measured using three single indicators: residential gross density; employment density and retail density. The land use entropy index (LUM) is used as a measure of land use mix[2]. Regional accessibility to workplaces was calculated using a gravity-based formula. Proximity indices for shopping centres and schools were calculated as the median distance between them and all residential units within a neighbourhood area weighted by the number of dwelling units. To consider the permeability of each residential neighbourhood, four different indicators were developed: the proportion of cul-de-sacs; street space allocation as a proportion of the total centreline distances of streets in each area; the route directness index was calculated by dividing the direct distance between an origin and destination by the actual network distance between them and the average of urban block area. The composite measures of the suitability of local streets for walking and cycling: PEF and CEF - was introduced for this study- represent the quality of the built environment in terms of physical activity options (sidewalks, bike lanes), safety (low traffic, safe for walking/cycling, street lighting), and attractiveness (appearance, building setback, variety in housing styles, landscape). The values for these two measures were obtained through a field observation survey (which was undertaken for 110 streets). The percentage of neighbourhood area covered by metropolitan public bus route buffers was also calculated to consider the availability of public transport services. The covered area is the area within 0.2 km of local bus routes, where pedestrian connections to transit areas are available from the surrounding area.

[2]Mean land use entropy was computed as:

$$\frac{-\sum_{i=1}^{s}(p_i)\ln(p_i)}{\ln(s)}$$

where p_i is the proportions of each of the s land use types which s is the number of land uses. Cervero , R., and K. Kockelman (1997). "Travel Demand and the 3Ds: Density, Diversity, and DesignTravel demand and 3D's: density; diversity and design." Transportation Research D **Vol. 2**(No. 3.). The number of seven categories considered for this study: residential; commercial; recreational; industrial; governmental; community services and open spaces.

Table 2: Urban Form Measures for Four Study Areas

Variable Name	Norwood	Unley	Para Hills	Golden Grove
Residential Density (persons/ha)	53.8	43.8	30.2	47.2
Employment Density (jobs/ha)	22.1	19.9	6.3	7.6
Retail Density (Percentage of Floor Space)	.03	.03	.001	.003
Land use mix entropy	.63	.72	.48	.38
Accessibility to Workplaces	872.6	754.0	1619.2	1633.9
Closeness to Shopping Complex (km)	.873	.754	1.619	1.634
Closeness to Schools (km)	1.051	.876	1.588	1.778
Proportion of cul-de-sacs	.35	.48	.51	.62
Route directness	1.22	1.37	1.53	1.61
Median block area (ha)	1.9	1.8	5.3	7.2
Pedestrian Environment Factor (PEF)	7.15	6.88	5.4	5.28
Cyclist Environment Factor (CEF)	6.14	5.84	5.09	4.72
Bus Coverage (percent)	.60	.64	.53	.73
Street Space Allocation	137.9	137.0	135.1	107.6

The aggregated results for four suburbs show that Norwood and Unley have better environment for inducing non-motorised travel modes. In addition to providing various public facilities in these suburbs, smooth and continuous sidewalks and on-street bike lanes have been provided in Norwood, and also Unley experienced some practice of traffic calming. Within two outer suburbs Golden Grove has successful landscapes, architecture and green spaces. Meanwhile both outer suburbs need traffic calming and development of pedestrian/cyclist infrastructure at local scale. While Golden Grove has similar advantages to Unley and Norwood in terms of suitability for walking/cycling, the walking and cycling trends in Golden Grove is lesser. Although there are relatively good infrastructure; facilities and landscape for pedestrian and cyclists in Golden Grove, the question remains why these residents do not? In fact, homogeneous land use patterns in Golden Grove are less encouraging walking/cycling activities.

Para Hills has the lowest share of non-motorised travel, which shows that the built form is really poor in encouraging sustainable travel. There are several disadvantages such as lack of sense of safety/security after dark; single-zoning; lack of community sense; lack of local facilities and a hilly topography.

The primary results from the figures illustrated on table 1 and table 2, reinforce the view that bringing origin and destinations closer together is associated to increase walking and daily non-work activity frequencies. The extent to which this association is casual is the matter that will be discussed in follow modelling debates. However, the fact remains that inner city residents exhibit higher levels of non-motorised activities.

Modal Choice modelling

Multinominal logit models were developed and used to evaluate the

effects of urban form/design variables on modal choice. The multinomial logit models estimate the likelihood of choosing a mode of travel by a household member. These models use socio-demographics of the sample households (and individuals) as exogenous variables along with the measures of urban form/design. For analysis, the individual is considered as the unit of analysis to achieve more accurate outcomes. Five mode alternatives were modelled:

- Metro-ticket public bus (C5): available to all individuals;
- Shared-ride (C4): available to all individuals;
- Driving alone(C3): available to adult members with a driver's licence from households that have at least one vehicle available;
- Walking (C2): available to all individuals;
- Cycling (C1): available to individuals except those aged over 76 and it is designated as being also available to individuals whose trip distance is less than the maximum distance biked by an individual in the sample.

The sample data contains 1,027 trip records taken from HTS2005 database to represent travel undertaken by individuals who resided in one of the four case study areas. One alternative specific attributes is calculated for non-chosen alternatives: travel time. Travel time is calculated using travel distance assuming constant average speed[3] for different modes by dividing the distance travelled by the speed of the mode alternative for every trip which is explained earlier.

Results

The modal choice models, including values of Alternative Specific Constants (ASCs), Alternative Specific Attributes (ASAs), values of attribute coefficients and their significance are detailed in Appendix 1. The adjusted ρ^2 values are good with values ranged from 0.36 to 0.56 (compared to the model with no coefficients). The t-statistics in the model are all above the threshold values of ±1.96 (95 percent confidence) showing that all ASCs and the coefficient estimates of attributes are all significant. The coefficients of the alternative specific attributes are all the expected sign and are significant. Model coefficients show the importance and strengths of urban factors and their ability to improve the explanatory power of behavioural models. Driving alone (C3) was taken as the referent alternative here. All analysis was done by LIMDEP ver. 7.0 (Greene 1998).

Living farther from Adelaide CBD leads to a lower propensity to make non-work trips by non-motorised modes. In addition, living farther from CBD, is associated with longer kilometres travelled for work purpose; they need to travel longer, or they may travel longer than they need? One reason is that employment has remained quite centralised in metropolitan Adelaide despite the overall trend to suburbanisation of jobs:"… 39 per cent of all jobs held by females in 1991 were still located in the CBD and inner suburbs, compared with 33 per cent for males (Forster 1999), p. 59)." In other words, the CBD is the largest employment

[3] The following values are applied: Car=46.4 , Walk= 4.25 , Bicycle=8 (female) or 11 (male), Public Bus=23 km/h (Primerano, F. (2004). Development of Accessibility Measures for Transport and Urban Planning. Transport Systems Centre. Adelaide, University of South Australia.

centre, with one third of Adelaide's jobs, and strong employment in the professional, office and service works. Other employment centres of smaller scale also exist in the south, north and northwest parts of Adelaide. One advantage of inner suburbs: Norwood and Unley is better access to employment centres in CBD. Baker (Baker 1997) suggested that the increasing number of employees in CBD is contributing to the continuing demand for terraces and town housing in inner Adelaide.

In addition, when job is located at least 2 kilometres far from home, the likelihood of walking/cycling to is decreased. On contrast, higher accessibility to workplace increases the propensity to walk/cycle to job. In fact, in Adelaide, the number of jobs relative to the resident labour force is relatively low, thus workers may find it difficult to find a job near their residential location. This low job ratio may result in a large average commute distance and time and related to this, lower shares of non-motorised modes. However, this finding recommend that employment or residential relocation may serve as a means for households to travel shorter, but it often functions as a last option when other strategies have proven insufficient. The reason for this reluctance to relocate is that substantial costs are involved in changing jobs and particularly the place of residence, not only for the worker but also his/her family.

As expected, where land use mixing is higher, the more likely an individual to be driven by a household member or drive a vehicle with passenger to non-work destinations such as shopping; recreation and open spaces; within the studied suburbs, the farther the shopping centre the less likely an individual catch public transport to there; Also within the two outer suburbs, the farther education/training centre or schools, the lower the likelihood of walking/cycling to as expected;

Within the two inner suburbs, higher network density is associated positively with the choice of walking/cycling. In addition, where street space allocation is higher, it is less likely an individual to be driven by a household member or drive a vehicle with passenger to work. Within the two outer suburbs, individuals tend to walk/cycle to non-work destinations where the neighbourhood designed as permeable. On the other hand, within the two inner suburbs, where urban block is larger the likelihood of catching public transport is lower. As part of non-work trips are taken by non-motorised means (15%-25% in studied areas), the impact of these variables may thus be a mixture of some local urban fabric factors to ease the movement through the area.

Within the two inner suburbs, individuals residing in single-family houses are less likely to walk, but higher shared-ride choice to work. On contrast, within the two outer suburbs, living in flats/apartments increases the likelihood of walking/cycling to non-work destinations. There was no clear casual relationship between residential/retail densities on modal choice in studied areas;

Travel time has a negative coefficient with choosing a mode for both work and non-work trips. In fact, the higher the values of this attribute the lower the utility, thus, the greater the travel time

the lower the benefit to the user. This finding is consistent with Crane and Crepeau (Crane and Crepeau 1998) showing the importance of travel time as a cost factor in a behavioural model. Furthermore, time plays a central role when deciding whether to engage in an activity. A theoretical treatment of the time constraint problem can be found in e.g. Jara-Diaz (Jara-Diaz 1998). The main consequence of the time constraint for the modelling of non-work trips is that making a trip of one kind reduces the time to make a trip of another kind.

Among the social factors, it was found that women in all four suburbs, are more likely to drive alone for work trips but also more likely to choose shared-ride choice for non-work activities. Females are more likely to walk in inner suburbs but less likely to ride a bike. Retired/unemployed individuals tend to use public transport. Young adults and part time/casual workers are likely to get to work with shared-ride mode. Individuals certified as driver are less likely to catch public transport. Individuals of low income households in inner suburbs tend to walk/cycle to work. Individuals of high income families in outer suburbs are less likely to catch public transport for non-work destinations, but those with low income tend to catch public transport to. Individuals of low income households in inner suburbs tend to walk/cycle to non-work destinations. The middle-aged individuals (36-55 years old) are more likely to drive with a passenger or be driven by a member of the household. The presence of children has potential impact, as many non work car trips are generated by children's needs, whether it is for school, recreational activities, or medical concerns. The study by (Rosenbloom and Burns 1993) showed that both mothers and fathers make a significant number of trips solely for children, with mothers making the majority of these trips for children up to 17 years old.

Conclusions and Implications for Further Investigation

This study is a primary step in Australian context with applying a disaggregated approach; considerable additional analysis is possible and is encouraged. The results would help to identify practical means to incorporate built environment aspects in local demand travel forecasting systems, to better understanding of the connection between urban form and travel choice behaviour. This study also may serve to assist other practitioners in Adelaide in their efforts to address the issue of induce travel, and to present better solutions for sustainability concerns.

The results showed that urban form not only makes more alternatives also makes a shift in modal choice. It is important to say that improving access to more travel choices does not routinely result to less car use. As pointed earlier, some people take their own transport due to their attitudes and perceptions. They drive because they believe in it and they want it regardless of cost, time and other constraints. In a unique study that looked at the association between land use, transportation and attitudes , it was found that personal attitudes is a strong predictor of travel behaviour, perhaps stronger than land use characteristics (Kitamura, Mokhtarian et al. 1997). While this research did not consider individuals' attitudes directly, the findings suggest that attitudes may potential influence travel decisions. What this

research suggests is making more alternatives and improvement in more sustainable travel modes is a necessary condition which should be given high attention in policy and planning.

Walking and cycling are fringe modes and represent rare behaviours in studied areas. Even among the inner city households, and considering all utilitarian and leisure travel, over a 24-hour period, only 6% cycled and 23%walked. So discussing the potential for urban form/design, to induce or enable walking/cycling should be taken with caution. As Sallis and Owen (Sallis and Owen 1999) discuss, "Interventions in built environment do not directly change behaviour. Interventions modify the factors that control behaviour, and those changes are expected to lead to improved behaviour" (p. 135). I mean we don't expect to have a dramatically shift in modal choice just through the modifications in community design. However, the theory that urban form/design matters remains valid and here suggests that one need to live in a quality design neighbourhood with a close proximity-less than 200m as now in Norwood for instance, to public facilities to have a significant impact on walking/cycling. The fact that residents of Norwood and Unley spend more time being actively in their neighbourhood may also be resulted from stronger sense of community and higher neighbourhood cohesion which are explaining by many non-physical factors not sole urban design features. Intuitively, spending more time out-doors, in turn, cause an increase in social communication and social cohesion over time, and perhaps as a result reinforce increased physical activity.

It would be interesting to see whether physical changes like the construction of sidewalks or improvement to bike lanes in an established suburb such as Para Hills are associated with changes in walking/cycling, after accounting for socio-economics. Does move to environments that offer better opportunities for walking/cycling associated with increase in walking/cycling? In this topic, recently, on going longitudinal panel studies have been started in Western Australia, which is surveying people travel behaviour prior to and after a residential moving (University of Western Australia 2004);
An important question remains is that if increases in modal shifting are not substantial enough to justify the cost of improvements in walking/cycling infrastructure especially in established suburbs? Since in new developments such as part of Golden Grove, zoning and subdivision rules can be modified to allow proximity to shops, parks and public services, but in established suburbs it is challenging. We could refer to other environmental/health benefits as well as social impacts.

Only four suburbs have been studied and a modest survey response rate has been obtained, so theses results are not necessarily generalisable unless they are replicated in other contexts and for populations with different socioeconomic attributes. A low variation between urban form variables in geographical areas, due to small sample size, plus lesser variation within suburbs makes the urban form measures less insensate to detect the effect of urban form on travel choices.
Information was collected only about the urban form of the sample sites. Such kind of information should be gathered from the characteristics of destinations of

daily commuting. Similarly, data on the destination of midday travel, trip chaining, or other related topics were not included, because the attraction of those trips made outside of the origin suburbs are important as well.

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Address for correspondence:

Ali Soltani
Ali.Soltani@postgrads.unisa.edu.au

Dr Andrew Allan
Senior Lecturer, School of Natural and Built Environments, University of South Australia

Dr Sekhar Somenahalli
Lecturer, School of Natural and Built Environments, University of South Australia

Dr Frank Primerano
Senior Transport Analyst, Department for Transport, Energy and Infrastructure, Government of South Australia

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