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Three very different papers in this issue highlight some key issues in the global transport debate that sit in a file labelled "important but don't do anything about it yet". The Australian cycling article by Gillham and Rissel reveals the disappointing picture around cycling take up and a decline in per capita cycling. This is a topic we have examined many times in this journal and repeat once again the nature of the basic problem. Cycling is not regarded as important by senior decision takers and politicians and is not allowed to take priority over motorised transport. In any situation in any UK or Australian city where a discussion is underway about improving cycling facilities the question of space allocation will be raised and the overriding priority given to cars and lorries will be asserted. This results in poor quality cycling facilities and a total environment that restrains bike use.

The article by Hallsworth and Wong may appear to be a long way from cycling as it carries out a detailed forensic examination of the supply chain around tomato production and consumption but it tells us something very important indeed about transport ideology. Consumer preferences, marketing and corporate strategies have provided a powerful cocktail of circumstances that impose very large burdens on the road system. There is a disconnect between the general conditions around production, consumption and logistics and its effects on road transport. We have far more lorries on the roads of the UK than we would have if these general system conditions changed to reduce lorry kilometres e.g. by the German lorry tax or by the substitution of "near" for "far" in food supply systems. Lorries are a very effective deterrent to cycling take up- hence the link between tomatoes and bikes. Once again policy makers fail to grasp fundamental arrangements and circumstances that add to traffic flow and traffic danger and refuse to adopt road traffic danger reduction as a primary objective.

Lorries in London have killed over 220 pedestrians and cyclists since 2000 and even though lorries represent only 5% of

trips in London they are involved in half to two thirds of cyclist deaths each year (Note 1). An intelligent transport policy that was seriously interested in promoting cycling would eliminate lorries wherever possible, give cyclists lorry-proof routes and equip lorries with cyclist detection technology. Fundamentally we have to change the supply systems described by Hallsworth and Wong and this in turn would increase cycling levels dealing with the problem raised by Gillham and Rissel.

The third paper by McLaren and Parusel emphasises the importance of road traffic danger, gender issues around safeguarding our children, the need to remove that danger and the overriding need to give children and parents a strong sense of safety and security on the everyday trips that form the bulk of our experience of road transport and degraded urban environments. The persistence of road traffic danger as a scourge and blight on the lives of millions is profoundly indicative of the lack of intelligence, ethics and common sense on the part of the vast majority of those making decisions about transport, traffic, budgets and quality of life. It is perfectly clear that the only acceptable solution to road traffic danger is the Swedish "Vision Zero" road safety policy and its approach to setting targets and reviewing progress to make sure that we are all doing as much as possible to achieve zero deaths and zero serious injuries in the road traffic environment. Vision Zero is still absent in most countries around the world and even more worryingly is rejected by many road safety and transport professionals (Note 2)

Note 1

See Me Save Me, RoadPeace Newsletter, Spring, 2012, Issue 33, page 20

Note 2

Whitelegg, J and Haq, G (2005) Vision Zero: adopting a target of zero for road traffic fatalities and serious injuries. A report for the UK Department for Transport. Stockholm Environment Institute, University of York (UK)

<http://sei-international.org/projects?prid=247>

**Australian per capita cycling participation in 1985/86 and 2011**

*Chris Gillham, Chris Rissel*

Cycling industry reports of significant bicycle sales in Australia suggest a boom in cycling participation. However, there are few systematic assessments of cycling in Australia allowing comparison over time. Two national surveys of cycling participation in Australia were examined. The earlier survey was of travel behaviour in 1985/86 and is the earliest known analysis of daily cyclist numbers in Australia. The second is a telephone survey of cycling behavior in 2011 used by the Australian Government as the baseline for its cycling promotion strategy to 2016. Population growth from 1986 to 2010 and the bicycle mode share for the journey to work were also examined. The Australian population aged nine years and over grew by 58.4% between 1986 and 2010 and the daily average number of bicycle trips grew by only 20.9%, representing a per capita decline in cycling. The proportion of Australian workers who used a bicycle to ride to work was largely unchanged at about 1% of journeys. A historical prioritization of the motor vehicle, lack of investment in cycling infrastructure and mandatory helmet legislation are likely to be explanatory factors. **Keywords:** cycling, Australia, travel behaviour

**Fresh produce, the supply chain and the environment – a case study.**

*Alan Hallsworth, Alfred Wong*

In recent decades, British citizens have become accustomed to eating fresh produce on a year-round basis: the example that we take is tomatoes. Through changes to transportation logistics and advances in horticultural engineering, demand for these tomatoes may be met either from (heated) greenhouses or by field cropping in hot, arid countries. Our chosen case study location is Portsmouth in the south of England where we found that the magnitude of CO2 emissions was substantial for greenhouse-grown tomatoes. The primary energy required in heating and lighting in British or Dutch greenhouses we estimated to be substantially greater than that required for the transportation of field-grown tomatoes from Spain. The purchase of seasonally-available tomatoes grown

in open fields with a “100-mile” radius of Portsmouth was found to have the lowest avoidable emission of CO2. As a part of citizens’ participation in mitigating greenhouse gas emissions, it may also be time to re- rethink the wider implications of consuming fresh produce such as tomatoes on a year round basis. To propose solutions, however, requires us to look critically at the implications of the current supply chain. **Keywords:** carbon dioxide, cropping, emission, energy, greenhouse, tomato, transportation

**Parental safeguarding children from road traffic: A global issue**

*Arlene Tigar McLaren and Sylvia Parusel*

This paper examines parental traffic safeguarding experiences in a high-income country where the automobility system is well established, and explores how international traffic safety discourses that seek to prevent child death and injury in low- and middle-income countries have turned to western parental models of responsibility and blame. These practices and discourses, which are vital foundations to automobility, take their toll on parents (especially mothers) and children. Our analysis suggests that for the sake of parents and children in countries around the world, land and transportation planners need to develop alternative designs to auto domination. **Keywords:** parents, everyday traffic safeguarding practices, gender, social class, automobility, global

## Australian per capita cycling participation in 1985/86 and 2011

*Chris Gillham, Chris Rissel*

### Introduction

The health benefits of cycling are well recognised (Bauman et al., 2008, Oja et al., 2011). Many countries around the world are seeking to increase population levels of cycling (UK Department for Transport, 2010, United States Department of Transportation - Federal Highway Administration, 2010), including Australia (Australian Bicycle Council, 2010).

The bicycle industry reports high levels of bicycle sales, to the extent that new bicycles have outsold new cars since 1999, leading to reports that Australia is experiencing its biggest cycling boom in the nation's history (Australian Cyclist, 2008). However, data on cycling participation in Australia has not been systematically collected.

In Australia, levels of cycling are measured differently in different states, either with household travel surveys in the capital cities or specific surveys which are conducted to focus on cycling. Nationally, there are only two regular methods of assessing cycling participation. One is the Exercise, Recreation and Sport Survey (ERASS) data, which is a joint initiative of the Australian Sports Commission and the state and territory government agencies responsible for sport and recreation (Australian Sports Commission, 2011). It assesses a range of physical activities in which respondents may have participated in the last year, including cycling. However, while it is annual, it has collected data only since 2001. A small increase in cycling from 2002 to 2008 has been noted (Bauman et al., 2011).

The other is the Australian Census, conducted every five years by the Australian Bureau of Statistics (ABS) which asks about travel mode to work, including by bicycle. The strengths of the Australian Census are that it is truly national, has a very high response rate, low rates of missing data, has population denominators when calculating percentages and is consistent over time. Weaknesses of the Census for cycling are that it is conducted

on a single weekday in the middle of winter (when cycling levels are lowest in the most populous southern states) and only asks about journeys to work. Therefore, it significantly underestimates cycling participation. Nonetheless, as a reliable tracking of one metric of cycling participation, it indicates that the proportion of trips made to work by bicycle has remained constant over the last 25 years at about 1% of the workforce (Mees et al., 2007).

As much cycling is recreational, or for utilitarian purposes (for example, shopping, visiting friends), commuter cycling does not represent all types of cycling. In 2011, it is difficult to say whether levels of cycling have increased in Australia over the last 25 years. The time frame is important because in 1990-92, Australian states introduced mandatory bicycle helmet laws which subsequent road surveys found had a significant negative impact on cyclist numbers (Robinson, 2007). Further, as the Australian population grows, absolute numbers of people cycling would be expected to increase. It is not known if the number of people cycling has increased more than the rate of population growth. This paper seeks to compare Australian cycling participation rates in 2011 with that of the earliest available data from a national travel survey (1985/6).

### Material and methods

#### Data sources

Three primary data sources were used. The Day to Day Travel in Australia 1985-86 (CR69) survey examined travel modes among Australians aged nine years and above (Adena and Montesin, 1988). The 1985/86 survey results are the earliest known detailed national count of bicycle use. The CR69 survey was a geographically stratified, random sample of households throughout Australia. For a randomly chosen day in the year-long survey period, details of all trips made by all members of the selected household were collected by a self-completed, mail questionnaire. It was conducted by data analysts IN-STAT Australia Pty Ltd for the Australian Federal Office of Road Safety and produced a final dataset of 145,000 trips by 45,000 people aged nine years and above

from 18,000 households. The 1985/86 CR69 survey findings were weighted against the 1981 ABS population Census (Australia's population was 14,576,330 in 1981 increasing 7% to 15,602,156 in 1986). CR69 was at its time of publication considered a definitive analysis of cycling participation in Australia in 1985/86.

Data for 2011 are from the 2011 Australian Cycling Participation survey (Munro, 2011) which was conducted in March and April 2011 and is the official baseline data source for the Australian Government's National Cycling Strategy 2011-2016 (Australian Bicycle Council, 2010). The 2011 survey was by telephone and contains details of trips by 24,858 people of all ages from 9,661 households across Australia. Data were weighted to the Australian Bureau of Statistics estimated resident population at a state/territory level on 30 June 2010. Only data for those respondents 10 years and older are reported here.

The estimated number of cycling trips per week from the Australian Cycling Participation survey varied from 4.7 in South Australia to 6.7 in the Northern Territory but was calculated to average 5.4 trips per week across Australia. There will be differences in proportion among age groups but the survey by Sinclair Knight Merz averaged these segments to determine that 5.4 trips per week is the average upon which Australia's future cycling strategy is based. The survey found that across Australia among respondents who had cycled in the past seven days, 60.5% indicated they cycled four times or less, 11.8% indicated between five and six times, and 27.8% indicated seven times or more. The assumption that all cyclists rode 5.4 times in the previous week produces an estimation of cyclist numbers that is more accurate than any national survey conducted in Australia since 1985/86 although it may be an overestimate.

Total population levels for Australia and for each state and territory are from the ABS population Census data for the years 1986 and 2006, and were estimated by the ABS for 2010. The number of people using a bicycle on their journey to work in Australia on Census day, and mode share (%) for bicycle use, for 1976,

1981, 1985, 1991, 1996, 2001 and 2006, are also provided (Mees et al., 2007).

#### Analysis

The population aged nine years and over in each state/territory and nationally, and the per cent increase from 1986 to 2010, are presented in Table 1. Weighted (for age) estimates of the total daily number of bicycle trips by state/territory in 1985/86 are presented (based on Adena and Montesin (1988), Table 4.1d, p123) totaling an average of 1,645,900 daily bicycle trips per day by people aged nine years or above nationally.

A similar total number of daily trips was not presented in the 2011 Cycling Participation report, but can be derived using reported cycling participation rates by age groups, and average weekly trips. For example, ABS estimated population data shows there were 2,285,937 people in Australia aged 10 to 17 on 30 June 2010. The 2011 Australian Cycling Participation survey (p. 23) shows 33.6% of people aged 10 to 17 cycled in the previous week, representing 768,075 Australians aged 10 to 17 who cycled an average 5.4 times in the previous week of survey. This totals 4,147,605 trips per week or an average 592,515 trips per day. The calculation is:  $2,285,937 \times 33.6\% = 768,075 \times 5.4 = 4,147,605 / 7 = 592,515$ .

Similar calculations can be made for the rest of the adult population. There were 7,079,921 people in Australia aged 18 to 39 on 30 June 2010. In 2011, 13.4% of people aged 18 to 39 cycled in the previous week, representing 948,709 Australians aged 18 to 39 who cycled an average 5.4 times in the previous week of survey. This totals 5,123,029 trips per week or an average 731,861 trips per day. The calculation is:  $7,079,921 \times 13.4\% = 948,709 \times 5.4 = 5,123,029 / 7 = 731,861$ .

Similarly, there were 10,144,447 people in Australia aged 40 years or older on 30 June 2010. In 2011, 8.5% of people aged 40 years or older cycled in the previous week, representing 862,278 Australians aged 40+ who cycled an average 5.4 times in the previous week of survey. This totals 4,656,301 trips per week or an average 665,186 trips per day.

The calculation is:  $10,144,447 \times 8.5\% = 862,278 \times 5.4 = 4,656,301 / 7 = 665,186$ . These three cumulative age brackets represent a daily average of 1,989,562 bicycle trips by Australians aged 10 years and over in 2011. Similar calculations were made for each state/territory.

## Results

Australia's total population aged nine years and over increased by 58.4% from 1986 to 2010 (12,488,000 to 19,786,884). *Table 1 (see page 11)* shows that the average daily number of bicycle trips increased by a third of this rate (20.9%) from 1,645,900 in 1985/86 to 1,989,562 in 2011. Whilst there is a greater number of cycling trips in 2011, this represents an effective decline in per capita cycling participation over 25 years.

The number of people using a bicycle on their journey to work in Australian cities on Census day, and mode share (%) for bicycle use, for every Census year since 1976 is shown in *Table 2 (see page 12)*. The mode share is very low in all years, but appears to have plateaued from 1981 to 1991, after which it declined 18% before going up again to the earlier levels in 2006 (Mees et al., 2007).

## Discussion

The results indicate that the population of Australia increased at almost three times the number of averaged daily bicycle trips after 25 years, representing a per capita decline in cycling over this period. This finding is supported by the journey to work statistics from the Australian Census from 1976, which shows no effective change in cycling mode share over this time in capital cities but a decline across Australia over the 15 years from 1991 to 2006.

It is possible that because cycling is an activity performed in a public space, it is more visible than other forms of travel (eg bus or train). Coupled with an increase in the absolute numbers of people cycling, this may contribute to the impression that there is an increase in the proportion of the population cycling. Based on our analysis, this impression is incorrect.

The findings in this study are consistent with an analysis of travel surveys in Perth, Western Australia, in 1986 and 2003-6. Ker found that there were fewer cycle trips per

day per person compared to 1986 and the bicycle mode share collapsed from 5.2% in 1986 to 1.6% in 2003-06 (Ker, 2010). Ker noted that 'there has been a long-term decline in the importance of cycling in transport activity, whether in terms of trips or cycle-km of travel. Although there has been an increase in cycle travel (km) for work purposes, this largely reflects the increase in Perth's population and increasing commuting trip distances' (Ker, 2010). Other reports of increases in the number of cyclists observed have not taken into account population growth (New South Wales Transport Data Centre, 2008).

In the US, commuter cycling mode share has remained stable at 0.4 - 0.6% for the past decade (Alliance for Biking and Walking, 2012). Compared with most countries, Australia has a low proportion of cycling participation (Pucher et al., 2010). Three of the four worst performing countries in global comparisons (Australia, Canada, US) have car-centric cultures and enforce either child or all-age bicycle helmet laws within their states or provinces.

We can only speculate as to the possible explanations for the lack of growth of cycling as a mode share in Australia. A lack of investment in cycling infrastructure (until more recently) is one factor, which is a component of a long standing prioritization of motor vehicles over active travel in transport policy circles. A correlation between expenditure on cycling infrastructure and cycling levels has been noted (Rissel, 2009). Australia's most significant investment in cycling safety was the introduction and enforcement of mandatory bicycle helmet laws in all Australian states and territories between 1990 and 1992. This policy resulted in subsequent declines in cycling participation within all age groups (Robinson, 1996, Smith and Milthorpe, 1993), with a similar pattern (a 51% reduction in cyclist trips (4% to 1% travel mode) from 1989 to 2006) observed in New Zealand when mandatory helmet legislation was introduced in 1994 (Land Transport New Zealand, 2006).

It is unknown if there has been a similar decline in per capita cycling participation from 1985/86 to 2011 among Australians aged less than nine years,

although numerous studies have shown a steep decline since the 1980s in the number of Australian children cycling to school (Van der Ploeg et al., 2008).

Despite a decline in the proportion of cycling trips relative to the population growth, the increase in total number of cycling trips over time is important for travel planners, as the available infrastructure must be adequate to accommodate the volume of bicycles.

### **Limitations**

There are a number of differences in the survey methods used. The earlier survey was a mailed written questionnaire and included a daily travel diary. It was a 13 month survey and is likely to under-report bicycle trips as it was weighted to the smaller 1981 population (n=14,576,330) rather than the 1986 population (n=15,602,156). The 2011 survey was by telephone and asked about cycling frequency in the past week, including the number of bicycle trips. It was conducted in March and April, the most popular months of the year for cycling, and may result in an overestimation of annual cycling participation in 2011 compared to the 1985/86 survey. However, these are the only available data sources which enable any type of comparison of population cycling over a longer timeframe.

In the earlier study participants were aged nine years and older and in the 2011 data the closest age category begins at 10 years. According to the ABS, there were 276,570 nine year olds in Australia on 30 June 2010. The 2011 Australian Cycling Participation survey found 49.1% of 0-9 year olds cycled in the seven days prior to survey and 33.6% of 10-17 year olds cycled in the seven days prior to survey. This averages to 41.35% as an approximation of cycling participation in the previous seven days by nine year olds, representing 114,362 Australians aged nine who cycled an average 5.4 times in the previous week, which totals 617,555 trips per week or an average 88,222 trips per day. With this estimate, the cumulative age brackets total 2,077,784 daily bicycle trips by Australians aged nine years or above in 2011, and a comparison of people nine years and over in 1985/86 and 2011 shows the number of bicycle trips per day increased by 26.2% from 1985/86 to 2011. Compared to the

increase of 58.4% from 1986 to 2010 of the population nine years and over, this adjusted analysis shows that on a 25 year comparison of cyclists aged nine years and over, the rate of growth in Australia's daily cycling participation was 32.2% less than the rate of population growth.

No measure of cycling frequency was reported in CR69. In order to calculate the average daily number of trips for 2011 and compare with the earlier study, we had to multiply the estimated number of people in each state who had cycled in the past week by the averaged weekly number of bicycle trips for that state/territory, and then divide this number by seven to get the average daily number of bicycle trips.

### **Conclusion**

Cycling participation has not kept pace with population growth, representing a per capita decline in cycling over the past 25 years. Reasons for this are unclear, although a historical lack of investment in cycling infrastructure coupled with mandatory helmet legislation may have contributed. It will be important to repeat the 2011 cycling participation survey.

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## References

- Adena, M. & Montesin, H. 1988. Day-to-Day Travel in Australia 1985-86. Canberra: Instat Australia Pty Ltd, Federal Office of Road Safety. [http://www.infrastructure.gov.au/roads/safety/publications/1988/pdf/Aust\\_Trav.pdf](http://www.infrastructure.gov.au/roads/safety/publications/1988/pdf/Aust_Trav.pdf) (last accessed October 2011).
- Alliance for Biking and Walking 2012. Bicycling and Walking in the United States - 2012 Benchmarking Report. Washington; , 2012. Washington.: Alliance for Biking & Walking.
- Australian Bicycle Council 2010. The Australian National Cycling Strategy 2011-2016 Sydney: Austroads
- Australian Cyclist. 2008. Bikes outsell cars - once again. <http://www.australiacyclist.com.au/article.aspx?aeid=5871> (Last accessed October 26, 2011) [Online]. Available: <http://www.australiacyclist.com.au/article.aspx?aeid=5871> [Accessed 26 October 2011].
- Australian Sports Commission. 2011. Exercise, Recreation and Sport Survey (ERASS) past report [Online]. Canberra: Australian Sports Commission. Available: <http://www.ausport.gov.au/information/scors/ERASS> [Accessed July 5 2011].
- Bauman, A., Merom, D. & Rissel, C. 2011. "Where have all the bicycles gone?" Are bicycle sales in Australia translated into health-enhancing levels of bicycle usage? *Preventive Medicine*, Available online 5 October 2011. doi:10.1016/j.ypmed.2011.09.011
- Bauman, A., Rissel, C., Garrard, J., Kerr, I., Speidel, R. & Fishman, E. 2008. *Cycling: Getting Australia Moving – Barriers, facilitators and interventions to get more Australians physically active through cycling* Melbourne: Cycling Promotion Fund
- Ker, I. 2010. Empty cells, damned half-truths and pseudo-statistics: The lot(tery) of the bicycle planner. <http://www.patrec.org/forum/2011/papers/7%20KER%20110816%20IK%20PATREC%20Paper.pdf>. Planning and Transport Research Forum (PATREC) 2010 Perth, Planning and Transport Research Centre, Curtin University.
- Land Transport New Zealand 2006. Sustainable and safe land transport – trends and indicators. <http://www.cycle-helmets.com/nz-ltsa-2006.pdf>. (Last accessed 20/5/2010). Wellington: Land Transport New Zealand.
- Mees, P., Sorupia, E. & Stone, J. 2007. Travel to work in Australian capital cities, 1976-2006: an analysis of census data. Melbourne: Australasian Centre for the Governance and Management of Public Transport and the University of Melbourne. <http://www.abp.unimelb.edu.au/gamut/pdf/travel-to-work.pdf> (last accessed October 2011).
- Munro, C. 2011. *Australian Cycling Participation 2011*. Canberra: Austroads.
- New South Wales Transport Data Centre 2008. *Cycling in Sydney: Bike Ownership and Use 2008*. Sydney: NSW Ministry of Transport and NSW Roads and Traffic Authority, 2008. (Last accessed January 21, 2012.) <http://www.bts.nsw.gov.au/Publications/Brochures/Brochures/default.aspx>.
- Oja, P., Titze, S., Bauman, A., De Geus, B., Krenn, P., Reger-Nash, B. & Kohlberger, T. 2011. Health benefits of cycling: a systematic review. *Scand J Med Sci Sports*, 21, 496-509.
- Pucher, J., Buehler, R., Bassett, D. R. & Danneberg, A. L. 2010. Walking and cycling to health: a comparative analysis of city, state, and international data. *Am J Public Health*, 100, 1986-92.

Rissel, C. 2009. Active travel: a climate change mitigation strategy with co-benefits for health. *New South Wales Public Health Bulletin*, 20, 10-3.

Robinson, D. L. 1996. Head injuries and bicycle helmet laws. *Accid Anal Prev* 28, 463-475.

Robinson, D. L. 2007. Bicycle helmet legislation: can we reach a consensus? . *Accident Analysis and Prevention*, 39, 86-93.

Smith, N. & Milthorpe, F. 1993. An observational survey of law compliance and helmet wearing by bicyclists in New South Wales - 1993. . Roseberry: Roads and Traffic Authority.

UK Department for Transport 2010. Active Travel Strategy. London: Department for Transport and Department of Health. Accessed 07/10/2011 from <http://www.dft.gov.uk/pgr/sustainable/cycling/active-travelstrategy/pdf/activetravelstrategy.pdf>.

United States Department of Transportation - Federal Highway Administration 2010. United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations. Washington: United States Department of Transportation - Federal Highway Administration.

Van der Ploeg, H. P., Merom, D., Corpus, G. & Bauman, A. 2008. Trends in Australian children travelling to school 1971-2003: burning oil or carbohydrates? *Preventive Medicine*, 46, 60-62.

	CR69 85/86 pop 9+	ABS 2010 pop 9+	Population % change	1985/86 trips	2011 trips	Trip % change	Population - Trip % difference
ACT	183,000	314,794	+72%	30,200	44,336	+46.8%	-25.2%
NSW	4,402,000	6,423,385	+45.9%	420,700	461,929	+9.8%	-36.1%
NT	99,000	197,015	+99%	23,800	37,345	+56.9%	-42.1%
QLD	1,957,000	3,971,290	+102.9%	321,900	427,539	+32.8	-70.1%
SA	1,114,000	1,470,964	+32%	171,100	126,444	-26.1%	-58.1%
TAS	357,000	449,477	+25.9%	29,300	51,394	+75.4%	+49.5%
VIC	3,293,000	4,931,527	+49.8%	466,100	615,147	+32%	-17.8%
WA	1,084,000	2,028,391	+87.1%	182,900	257,024	+40.5%	-46.6%
<b>AUS</b>	<b>12,488,000</b>	<b>19,786,884</b>	<b>+58.4%</b>	<b>1,645,900</b>	<b>1,989,562</b>	<b>+20.9%</b>	<b>-37.5%</b>

Table 1: Persons aged nine years and above by state/territory, average daily bicycle trips, and per cent change, 1985/86 and 2010/11

**ALL CITIES**

	1976	%	1981	%	1986	%	1991	%	1996	%	2001	%	2006	%
<b>Total Workforce</b>	<b>3,970,683</b>		<b>4,252,328</b>		<b>4,426,395</b>		<b>4,671,066</b>		<b>4,949,277</b>		<b>5,413,746</b>		<b>5,930,698</b>	
<b>Travelled to Work</b>	<b>3,587,970</b>		<b>3,658,439</b>		<b>3,785,593</b>		<b>3,917,302</b>		<b>4,149,031</b>		<b>4,523,295</b>		<b>4,977,476</b>	
<b>Public Transport</b>	<b>847,280</b>	<b>23.6%</b>	<b>774,543</b>	<b>21.2%</b>	<b>732,447</b>	<b>19.3%</b>	<b>683,988</b>	<b>17.5%</b>	<b>605,328</b>	<b>14.6%</b>	<b>684,657</b>	<b>15.1%</b>	<b>756,776</b>	<b>15.2%</b>
Train	377,077	10.5%	379,281	10.4%	373,398	9.9%	359,819	9.2%	380,529	9.2%	435,187	9.6%	467,684	9.4%
Ferry/Tram	87,834	2.4%	71,067	1.9%	64,473	1.7%	48,684	1.2%	28,815	0.7%	39,843	0.9%	44,272	0.9%
Bus	382,369	10.7%	324,195	8.9%	294,576	7.8%	275,485	7.0%	195,984	4.7%	209,627	4.6%	244,820	4.9%
<b>Car Total</b>	<b>2,444,050</b>	<b>68.1%</b>	<b>2,609,003</b>	<b>71.3%</b>	<b>2,796,885</b>	<b>73.9%</b>	<b>2,936,757</b>	<b>75.0%</b>	<b>3,234,458</b>	<b>78.0%</b>	<b>3,464,712</b>	<b>76.6%</b>	<b>3,788,930</b>	<b>76.1%</b>
Car driver	2,027,990	56.5%	2,210,153	60.4%	2,429,260	64.2%	2,567,507	65.5%	2,911,269	70.2%	3,154,271	69.7%	3,466,924	69.7%
Car passenger	416,060	11.6%	398,850	10.9%	367,625	9.7%	369,250	9.4%	323,189	7.8%	310,441	6.9%	322,006	6.5%
<b>Bicycle</b>	<b>30,259</b>	<b>0.8%</b>	<b>40,644</b>	<b>1.1%</b>	<b>43,218</b>	<b>1.1%</b>	<b>43,759</b>	<b>1.1%</b>	<b>36,924</b>	<b>0.9%</b>	<b>42,738</b>	<b>0.9%</b>	<b>55,599</b>	<b>1.1%</b>
<b>Walked Only</b>	<b>200,857</b>	<b>5.6%</b>	<b>160,084</b>	<b>4.4%</b>	<b>146,674</b>	<b>3.9%</b>	<b>153,728</b>	<b>3.9%</b>	<b>144,644</b>	<b>3.5%</b>	<b>156,358</b>	<b>3.5%</b>	<b>198,745</b>	<b>4.0%</b>
<b>Total of Other Modes:</b>	<b>65,524</b>	<b>1.8%</b>	<b>74,165</b>	<b>2.0%</b>	<b>66,369</b>	<b>1.8%</b>	<b>99,070</b>	<b>2.5%</b>	<b>127,677</b>	<b>3.1%</b>	<b>174,830</b>	<b>3.9%</b>	<b>177,426</b>	<b>3.6%</b>
Motorbike/scooter	38,469	1.1%	46,963	1.3%	39,767	1.1%	29,030	0.7%	25,473	0.6%	24,724	0.5%	34,972	0.7%
Taxi	27,055	0.8%	27,202	0.7%	26,602	0.7%	21,724	0.6%	18,051	0.4%	15,717	0.3%	15,739	0.3%
Other									53,174	1.3%	21,324	0.5%	28,684	0.6%
Other Two Methods									29,662	0.7%	36,320	0.8%	28,353	0.6%
Other Three Methods									1,317	0.0%	2,121	0.0%	1,959	0.0%
Truck											74,624	1.6%	67,719	1.4%
<b>Transport Mode to Work TOTALS</b>	<b>3,587,970</b>	<b>100%</b>	<b>3,658,439</b>	<b>100%</b>	<b>3,785,593</b>	<b>100%</b>	<b>3,864,792</b>	<b>100%</b>	<b>4,149,031</b>	<b>100%</b>	<b>4,523,295</b>	<b>100%</b>	<b>4,977,476</b>	<b>100%</b>

Table 2.: 'Travel to Work in Australian Capital Cities, 1976-2006: an analysis of census data' shows ABS census data on methods of travel to work in all Australian cities from 1976 to 2006 ((Mees et al., 2007) \*)

## **Fresh produce, the supply chain and the environment – a case study.**

*Alan Hallsworth, Alfred Wong*

### **Introduction**

During the past 50 years, supply of fresh foods to urban centres in western nations has increasingly shifted from local or regional farms to agri-business farms located often many thousands of kilometres away. Because of the relentless pressure from expanding housing estates and out of town shopping developments, the local countryside is steadily being decimated by extensive bétonisation. In addition to lower costs of transportation [Hopzafel 1995; Whitelegg, 1997] the access to the outputs of “cheap” labour that may be toiling under extremely harsh conditions [Lawrence, 2011] has become an inherent feature of the global agri-food business. We argue, as have others, that the true burden of transportation costs rises further when one factors in environmental emissions. We also have specific reasons for choosing the example of tomatoes. Unlike say, bananas, tomatoes have traditionally been grown as a seasonal crop in the British Isles. Furthermore, such seasonality was traditionally accepted as a perfectly normal supply constraint. The far more recent practice of meeting out-of-season demand has led to the establishment of large-scale greenhouses in northern latitude countries to grow fresh produce on a virtually year-round basis. To a certain extent, this new consumer demand is both created and promoted, since the greenhouse vegetable business would not be viable if demand remained seasonal on grounds of taste.

Off-season supply of our example – tomatoes – is, then, provided in part from large greenhouse operations that require substantial lighting and warm temperatures for satisfactory crop growth. Fossil fuel is used routinely to provide the required energy. In some countries there have been initiatives to build vegetable greenhouses adjacent to existing power generation facilities, for the purpose of using low-quality waste heat and CO<sub>2</sub> in the flue gas (Anon., 2009; Grupa Mularski, 2012). Supplementary lighting would still require electric power: either on-site

generated or externally purchased and all mostly generated by the combustion of fossil fuels. Even with on-site co-generation, the inescapable fact is that fossil fuel must be burned with the attendant release of CO<sub>2</sub>. The purpose of this study is to assess the CO<sub>2</sub> emission intensity of four different means of supplying tomatoes to Portsmouth, in the context of new modalities of the modern agri-food business.

### **Avoidable CO<sub>2</sub> emissions**

The concept of “Food Miles” was first popularised in the 1990s as a convenient means to quantify the amount of CO<sub>2</sub> emitted in the transportation of food from “the farm to the fork” (Sustain, 1994; Pretty et al., 2005; Soil Association, 2007; Bomford, 2010). Such analyses generally confirmed that air transportation, using untaxed aviation fuel, of perishable foods from overseas (particularly low-income less-developed countries) to the UK would generate substantial emissions of CO<sub>2</sub> (Smith et al., 2005). The corollary is that this emission of CO<sub>2</sub> could be avoided if purchase of locally grown food was prioritised. Indeed, Garnett (2003) argued that once airfreighted produce was landed in Britain the additional contribution of local ground transportation was ‘negligible’. We however, believe that savings can still be made. Critics of “Food Miles” were quick to point out that off-shore production of vegetables may help to reduce poverty in the ‘impoverished’ production countries (Legge et al., 2007; Ballingall and Winchester, 2008; Garside et al., 2008; Hogan and Thorpe, 2009). Ominous warnings were made that the adoption of the “Food Miles” criterion would impoverish millions of poor people in sub-Saharan Africa and elsewhere. These off-shore poor people are seen as being dependent on employment from growing vegetables for export to wealthy countries. The contrary explanation is that widespread hunger is caused in no small part by the unfettered expansion of commercial vegetable cropping for export, promoted not least by the IMF, which results in the re-allocation of limited arable land and scarce water supply away from staple production for domestic use (Krznicaric, 2005; Hartwich, 2009; Vivas, 2009). Local food self-sufficiency around the world is declining precipitously

(de Schutter, 2011) which is one reason why we chose tomatoes which can feasibly be grown locally in the West. The elimination of long-distance imports of food which can be grown locally would free up land for food self-sufficiency in developing countries. The important criterion is to look at how rewards, as well as costs, are shared along the food chain and to take long term not short-term perspectives. It is, of course, worth noting that unfair sharing of costs and benefits of produce that cannot be grown locally – bananas again come to mind – is another means to disadvantage the usually powerless producer. We commend the trend observed in Britain to massively increase the proportion of sales of non-local crops such as bananas or coffee that are Fairtrade. Using “Food Miles” to depict the transportation of food remain a valid concept to compare carbon footprints of food supply (Smith et al., 2005). However, the impact of CO2 emissions should be expanded to include the avoidable generation of CO2 inside the farm-gate. For example, local greenhouse operations that create artificial growing conditions may have the same CO2 emission levels as open-field cropping in distant off-shore locations. In our analysis we make use of measures developed in British Columbia, Canada, where we find the tomato supply “problem” to be broadly similar. Figure 1 shows the research boundary of the present study. We find that there are several important market elements that influence the CO2 emission intensity in the delivery of food from “farm to fork”.

### **Supermarket power**

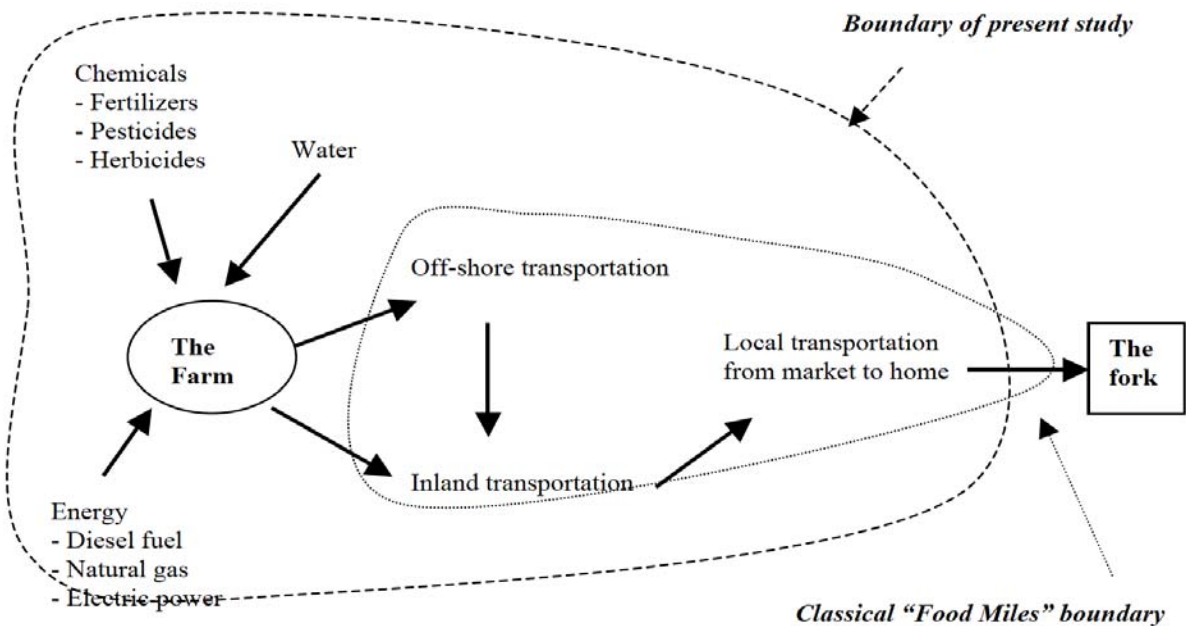
In the UK, there is an ongoing trend to supermarket concentration (Hallsworth et al., 2008; de Kervenoael et al., 2010). The market leaders strive to further consolidate their market dominance - and not only by building new stores on locations such as playing fields, allotments and traditional marketplaces. In past research, Portsmouth has been seen as ‘typical’ of most English cities of its size (Clarke et al., 2006) - when one measures its shopping provision against the national norm it sits close to the middle. That is, it has several branches of the four now-dominant food retailers that supply 75% of the UK’s regular food shopping. There has,

both locally and nationally, been a steady, relentless, reduction of store choice as local and regional food chains and specialist shops such as butchers have been bought up and/or driven out of business. There are parallels in other product areas too – some of which illustrate well how excess food miles are structured into the present supply chain. Some Portsmouth stores sell Gales Ales – brewed just 15 km away in Horndean for many decades. At one stage that beer may have travelled directly to local shops, later it would have been re-routed via Regional Distribution Centres (RDCs). All retailers have learned (initially from WalMart) that the best way to control food supplies is to control food distribution logistics. Whereas, in the past, local producers may have served local stores directly, the Big 4 (Tesco, Morrisons, Sainsburys and ASDA), all now centralise goods into RDCs for onward distribution in their own trucks or those of their chosen contractors. The Gales brewery is now closed following a takeover – a process that led to local suspicions that the brewery had been occupying what could be lucrative house-building land. Varieties of Gales beer are now brewed in London and then travel to Portsmouth via RDCs. Similar findings include the examples of traditional products from Cornwall such as clotted cream and Cornish Pasties that appear in shops back home in Cornwall only after having made round trips of some 500km to distribution centres near Bristol: mostly using the heavily-congested M5 motorway. This system, as has often been noted, means that HGVs filled with produce act as rolling warehouses. Even small convenience stores on local streets – if run by the major chains - will be serviced by full-sized trunks.

There are, then, several operational characteristics that automatically erode local distinctiveness. As noted above, local food can go on long journeys simply to reappear in a local shop: hardly a recipe for sustainability or security. Cementing such power is the rise of ex-works or farm gate pricing. Before RDCs became the norm, manufacturers and suppliers could have been using their delivery system to supply all of the 50 or more supermarket chains that once existed in the UK. Not only were they soon reduced to delivering to dedicat-

ed RDCs, that role – as powerfully shown by Potter et al. (2006) – has also been undermined. Retailers or their contractors increasingly price ex-works and take product direct from factory or farm. Accordingly, a company that once delivered all of its own produce to the national retail system might now lose 75% of that aspect of its delivery business. It is not difficult to infer that an expensively-assembled corporate delivery fleet that has just lost 75% of its cargo might well be disposed of entirely – leaving residual customers with delivery problems. Such changes take place usually not through negotiation but as an exercise in sheer market power that is reminiscent of the work of Bakan (2004).

ess of small scale resistance is, however, counterbalanced by ongoing trends towards ever-increased industrialisation of agriculture in the UK. Echoing trends elsewhere in the world, sub-regions in the UK are increasingly dominated by single crops. This makes internal regions ever more dependent on other sub-regions for food variety. Worse still, thoughtless over-intensification (particularly of wheat production) is destroying familiar landscapes and natural habitats. Such traditional landscapes have long been the habitat of plant, animal and insect species that are themselves a key part of biodiversity and plant life-cycles. The push for productivity (“driving down the cost in supply chain



**Figure 1. Elements of external avoidable CO2 emission in food supply from “farm to fork”.**

### Local producers

With some 75% of the grocery trade held in limited corporate hands it might be assumed that there would be few ways to resist their products and their prices : broadly that remains true. Farmers Markets, for example, can be seen as a form of resistance to the homogenising powers of the Big 4 retailers. Farmers Markets were in existence for centuries in England before the advent of the supermarkets. Though minuscule in terms of trade volumes, Farmers Markets have regained prominence during the past 20 years – not least because many smaller farmers were seeking to avoid the supermarket route to market (Bentley et al., 2003). This proc-

management”) is having the adverse side effect of decreasing long-term food security. Before moving on, we should note that the monopsonistic buying power of Britain’s leading food retailers has other implications for our analysis. It is accepted that under current Competition Law it would be an offence for retailers to collude to keep prices high. However, since most of the Big 4 are omnipresent, it is extremely easy for them to observe the current selling prices of rivals and this is assisted by price comparison websites. Our in-store observations of prices in November, 2011, showed a remarkable similarity in the base price of the cheapest standard tomato even though the price of more specialised varieties varied greatly. It did not seem to matter where those to-

tomatoes were sourced – the base price remained roughly constant. This reminds us of the suggestion by Lines (2001) that the big retailers are “price makers”. Note that for a less widely-purchased line – leeks – one of the Big 4 was selling in-season leeks at £1 per kilo in February 2012 – a week later its cheapest available were £2 a kilo. This reflects the power of the Big 4 to alter prices at will but may also be part of using so-called Edgeworth curves. It will be noted that supermarkets like to announce almost daily price cuts. Indeed, the perception of policymakers that they do pass on price cuts may account for the lack of political resistance to the format. However, the Edgeworth curve tactic is to make a sudden, sharp increase in prices (as by increasing leeks from £1 per kilo. to £2 a kilo.) This sudden, sharp increase in prices is then followed by a long sequence of very small price cuts that could eventually take the price back to £1 per kilo. So, over the course of a month, a supermarket could make positive publicity out of making price cuts every day - bar the one day on which the sharp increase occurred. They dictate the price at which produce is offered to the general public simply because they control most of the shelf space – just as they control distribution logistics. The question remains as to how this market power can be resisted when rival forms of outlets and rival distribution systems are in relative decline. We can certainly suggest that the buying public itself is increasingly-poorly placed to resist. As incomes in Britain have polarised, with the poor falling further behind, there has been a rapid rise in so-called “pound shops” where all items are priced at a pound. On the remaining traditional street markets, bowls of produce (of undetermined weight and therefore unknown price per kilo) are now offered for sale at a pound. The British public is being educated to see the price of one pound sterling as “cheap”. Accordingly, the big 4 are following suit by price-marking packaged vegetables “flashed” at one pound. Another practice is to sell items normally sold by weight – tomatoes - by the pack of four or six: again it is not always clear what is the actual price per kilo. Nor, we suspect, does the general public have much knowledge of how little of the selling price goes to the producer or farmer. Finally, of course, there are

those who do not actually wish to resist the temptation to buy the exotic when the local is equally available. At the heart of conspicuous consumption sits the display of what has been acquired and purchasing the exotic feeds that image. Substantial educational activity needs to be undertaken if change in public behaviour is to flow.

### **Tomatoes available for purchase in Portsmouth, England**

The ‘natural’ availability of tomatoes in northwestern Europe is at its height from mid-July to October (Anon., 2012). The shoulder months are April to mid-July, and November. The poorest months are December to March. In Portsmouth, tomatoes are routinely imported from Almería (Spain) and the Netherlands. In the Netherlands, greenhouse cultivation is the customary method to ensure adequate temperature and incident light for virtually year round cultivation. During the summer months, local field-grown tomatoes are available from within a 100-mile radius of Portsmouth, which would cover virtually all of southern England, including prime agricultural land in Kent. Smith and MacKinnon (2007) had popularized the concept of “eat local” and acceptance of natural seasonality enhances this. The CO<sub>2</sub> emission levels expected for the delivery of tomatoes from farm to fork are summarized in Figure 2. The data presented should be considered only as an order of magnitude as various changes in travel routing, traffic delays, and truck loading intensity could alter the actual CO<sub>2</sub>-emission figures significantly. The mode of travel (Kia Rio compact car), distance travelled (2 km total) from Home to Portsmouth grocery store for the single purpose of purchasing 1 kg of tomatoes was assigned arbitrarily as an extreme example. Figure 3 shows that the greenhouse-grown tomatoes would have substantially higher CO<sub>2</sub>-emission footprint because of essential high consumption for primary energy for heating and lighting. In contrast, the proposition of supply within 100-mile radius has a very small CO<sub>2</sub>-emission footprint.

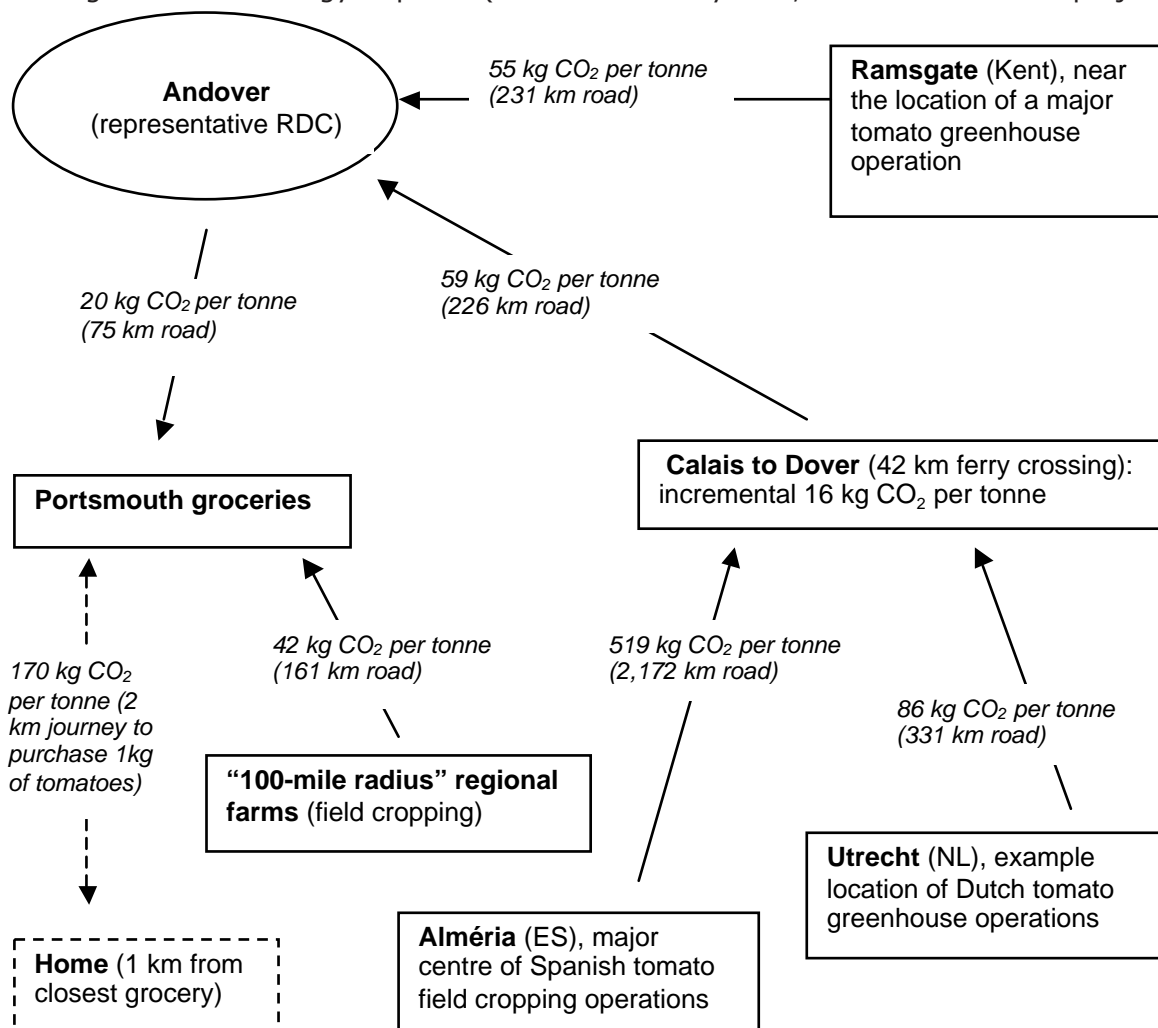
We should add some important caveats at this point: availability of reliable market data is notoriously difficult in Britain where once-public bodies (and their mar-



ket information) have been privatised or outsourced. Here we work with the best data that we can find. Accordingly, our comparison was constructed on the basis of best-available sources of energy demand data reported by Albright and de Villiers (2008). Reinforcing our interest in Canada, for the field cropping of tomatoes, the hot and arid climatic conditions of San Joaquin Valley in California are considered to be largely similar to those of Almería, Spain. It is recognized that there is an increasing practice of tomato cropping in passive greenhouses in the Almería region (Tello, 2002). Specific energy consumption data for tomato cropping in the designated locations were not readily available. The Dutch greenhouse energy reports (Smit

and van der Velden, 2008; van der Velden and Smit, 2010) provided only non-specific or incomplete data for tomato cropping.

A 2011 EU-funded study report did not provide any absolute figures on energy consumption in tomato cropping in Spain or the Netherlands (Montero et al., 2011). There was also very scant information available on tomato production in the UK (Foster et al., 2006). In a separate study conducted for DEFRA, Williams et al. (2006) cited the primary energy demand to be 125 MJ per kg of tomatoes produced in UK greenhouses. In the best-case scenario of 100% energy supplied through a combined heat and power (CHP) generation system, these researchers projected



**Figure 2. Estimated CO<sub>2</sub> emission for the transportation of tomatoes from Ramsgate (Thanet, Kent), Almería (ES) and Utrecht (NL) to Portsmouth.**

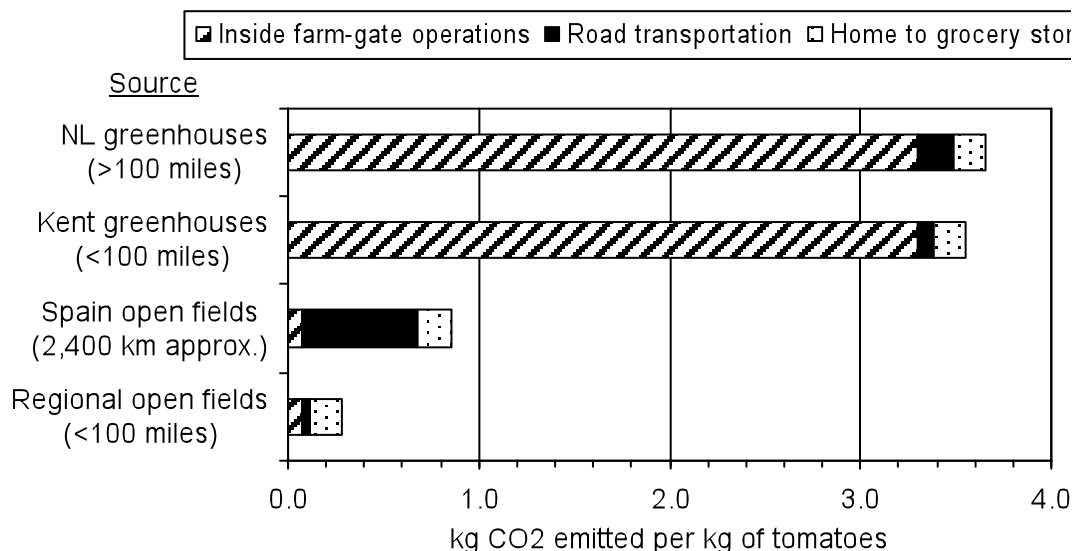
Notes:

1. Baseline 0.259 kg CO<sub>2</sub> per tonne-km for UK-average all rigid (Table 7e in DEFRA, 2011). For comparison, the baseline figure of all UK-average HGVs (heavy loads vehicles) is 0.127 kg CO<sub>2</sub> per tonne-km (in Table 7e in DEFRA, 2011).
2. Baseline 0.384 kg CO<sub>2</sub> per km-tonne for large RoPax ferries (Table 7g in DEFRA, 2011).
3. The 2-km journey from home to grocery store is based on the use of a compact car with the lowest CO<sub>2</sub> emission rating of 85 g CO<sub>2</sub> per km (Kia Motors, 2012)

that the primary energy demand would decrease to only 37 MJ per kg tomatoes; there was no disclosure of any supporting information. It is difficult to understand how CHP deployment could reduce primary energy demand, if fossil fuel was still used as the primary fuel. In principle, any combination of heat and power supplied, through the use of CHP or not, to a greenhouse would add up largely to the same amount of total energy required. The only possibility to realize the

## Seasonality

There was once great public interest in the arrival of the very first new season Jersey Royal new potatoes – a phenomenon now almost forgotten as earlier supplies appear routinely from Egypt and elsewhere. As an informant whose family had grown strawberries on their Hampshire market garden told us, their profits were dependent almost entirely on the 'new season' demand. Year-round supplies



**Figure 3. Comparative avoidable CO2 emission for 4 different tomato-supply models on a farm-to-fork basis.**

### Notes:

1. Greenhouses: exclusive of greenhouse structure and equipment; inclusive of farm chemicals, consumables and direct energy uses; adapted from Table 5-2 data for south coast England (Albright and de Villiers, 2008). NL greenhouse tomato yield was reported to be 479.4 tonnes per hectare in 2010 (FAOSTAT, 2012). Energy demand (in MJ) per hectare was converted to kg CO2 per kg product, on the basis of natural gas equivalent of 0.056 kg CO2 per MJ (Herold, 2003).
2. Open fields: exclusive of farming structure and equipment; inclusive of farm chemicals, consumables, irrigation and direct energy uses; adapted from Table 3-13 data for San Joaquin Valley, California, (Albright and de Villiers, 2008). ES (field) tomato yield was reported to be 74.0 tonnes per hectare in 2010 (FAOSTAT, 2012). Energy demand (in MJ) per hectare was converted to kg CO2 per kg product, on the basis of natural gas equivalent of 0.056 kg CO2 per MJ (Herold, 2003).

projected favourable outcome would be to use biomass fuel for the supply of CHP energy (Wong, 2010). In the promotion of tomato cropping in greenhouses, Williams et al. (2006) commented that "..... provides a fresh salad crop for much more of the year than was previously possible and so enhances the national diet and reduces our dependency on importing alternatives." It is highly questionable as to whether tomato is a critical element of the "national diet" and we refuse to see a return to seasonality as a great hardship.

from abroad removed that unique 'spike' in demand and financially ruined the family business. Nevertheless, it is certainly feasible that the "national diet" could be enhanced by other substantially less CO2-emission intensive food supply practices. As an extreme case we might even speculate that tomatoes could be grown in the natural "home land" in Eastern Caribbean and transported by ocean-going vessels to the UK, CO2 emission from heating and lighting of greenhouses in northern latitudes could be avoided (Wong, 2012) and the CO2-emission footprint could be minimized. An ocean-going vessel is generally recognized to consume substantially less fossil fuel than truck transportation

on land (DEFRA, 2011) though there are wider debates surrounding emissions from shipping, too. It will be seen that our tomato example, is, deliberately, different from that of, say, green beans. Unlike tomatoes, most green beans sold in the UK are grown in Kenya. Typically, the goods are transported nightly by air freight from Nairobi to UK airports. Air freight has to be deployed as the shelf life of green beans is only 3 to 4 days after harvest. Domestically-grown green beans are available only during the summer months and, as noted, they will then reach Portsmouth via often-distant RDCs. For reason of labour and energy economics, green beans are rarely grown commercially in northern-latitude greenhouses. The avoidable CO<sub>2</sub> emission from the transportation of field-grown green beans from Kenya and of local farms to Portsmouth would be 4.2 kg CO<sub>2</sub> per kg green beans and 0.042 kg CO<sub>2</sub> per kg green beans, respectively<sup>1</sup>. This amount of CO<sub>2</sub> emitted in air transportation may be compared to the value of 3.3 kg CO<sub>2</sub> generated per kg of tomatoes produced in greenhouses in the Netherlands or the UK.

In summary, then, for generations, British citizens have been eating vegetables on the basis of local seasonal availability. With the advent of improved transportation logistics and horticultural engineering, certain vegetables have been popularized to offer availability on a year round basis. There are notable environmental consequences (such as higher CO<sub>2</sub> emission) of this evolution of food supply. The classical analysis of "Food Miles" does not include the importance of energy input for greenhouse cropping in northern latitudes. In the example case of supplying NL (or UK) greenhouse tomatoes to the Portsmouth point of purchase, the magnitude of CO<sub>2</sub> footprint would be about the same as that of importing fresh vegetables by air freight from Kenya into the UK. The purchase option with the lowest CO<sub>2</sub> footprint would be seasonal field-cropped tomatoes supplied directly by regional farmers located within a "100-mile" radius of Portsmouth. In view of the present findings, it may be timely to re-think the current, entirely non-essential, 'accustomed demand' for out of-season fresh foods.

## The wider perspective

We have already ranged widely in our search for systemically critical factors and have noted the power of supermarkets. That also means that we have identified entrenched impediments to change. When, as noted above, land on which food could be grown is sacrificed to other uses, especially for housing for those who will themselves need food, then policymakers are blithely assuming that cheap food can always be transported in from elsewhere: just like consumer goods. The latter have fallen in price as China -admitted to the WTO less than a decade ago - has changed the rules of the consumer goods game with low wages trumping transport costs (even fully-costed ones) as the core production price criterion. Food prices, however, are likely to do little other than rise even when manipulated by powerful "price maker" retailers - often on the basis of what the local market will tolerate. This is what our empirical food price data (from the Portsmouth area) seem to be showing. Prices set at what the local consumer can afford to pay is also the essence of the so-called 'grey' market and can easily outweigh transport and production costs. Accordingly, a complete analysis of pricing would require some consideration of what retailers can and cannot do: selling at below cost is a common problem, for example. A very common market prohibition is against Resale Price Maintenance (RPM) - only just making a comeback in the USA following the Leegin decision. RPM gives manufacturers a say in final prices - yet most jurisdictions uncritically hand that power virtually entirely to retailers. Again, our concern is for food - not cheap Chinese consumer goods. We are concerned that the vital food supply system is increasingly being placed into the hands of a small oligopoly that can determine what gets delivered, and where, and that also controls the price. Practices such as Factory Gate Pricing are inherently anti-competitive because they remove the ability of suppliers to serve other, smaller, retailers. Yet more insidious is the hugely-anticompetitive practice of Category Management where a market-leading supplier controls not only its own shelf access but that of its rivals on behalf of a partner retailer. The major retailers have been closely linked to

consolidation in the manufacturing, agriculture and food-processing sectors as size becomes ever more important to power negotiations. This sits in stark contrast to the wishes of those who would wish to see more secure, small-scale, locally-sourced and inherently more environmentally-friendly food production. There are powerful global forces at play when product prices are being set – and political decisions are being made as to who is empowered to set those prices. We sense that the particular interface of transport and the environment is still not being accorded anything like the prominence that it deserves. Time is running out: reliable food supplies may do likewise: so what measures might help?

If health is measured by obesity then health in much of the western world is not improving. Many lay a great deal of the blame at the door of the processed ready-meal, fast-food culture that pervades the west – and which is supplied by supermarkets. A wholesale adoption of the slow food mentality, resurgent cooking skills and an abandonment of cook-chill fast foods would be an important start. The virtually automatic, instant-replenishment of short-dated ready meals in supermarkets and convenience stores contributes greatly to road miles. Another growing problem is that in countries with a weak food culture, much of what is purchased is thrown away uneaten. We thus pay to transport produce to stores, then to home and then to the refuse dump. Sell-by (and, in particular use-by) dates on packaged food lead to perfectly good produce being discarded by those who fail to realise that it remains perfectly good and safe to eat. A re-education away from imported out-of-season products and towards more seasonal, locally-supplied freshly-grown foods would also help greatly. Some argue that cook-chill fast foods fit with the busy, long-hours lifestyle found in/ imposed on countries such as the UK. A continuation of present economic trends implies, however, that even more of the population than at present will soon find itself with cooking time on its hands.

### **Transport policy implications**

As we have noted, there exists within food transport a complex network of Regional  
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Distribution Centres – each dedicated solely to goods acquired by a particular major retail chain. Indeed it has been suggested that China's fifth biggest trading partner is not a nation but WalMart. This pattern sits in total contrast to the pre-war British system where independent wholesalers – supplying to all – played a far greater role and regional food chains, and their smaller rivals, would go to their regional wholesaler for supplies. Indeed, most retailers commenced trading in a particular region and there is no reason why they should not have remained regional. Sadly, in Britain at least, lax merger and takeover rules have eroded such patterns. If trends were reversed, rather than have traffic running inter-regionally to and from several dedicated retailer RDCs, trucks could supply all retailers within a region from one shared regional RDC. Our conclusion is that by running intra-regionally rather than inter-regionally, very substantial road miles could be saved. We cannot precisely quantify this because our calculations are based on a single product – tomatoes – and so we urge others to research the implications for a wider range of goods. A further caveat is that meaningful change would require real political willpower that has not lately been forthcoming. We would hope that more localisation would decrease road miles to larger stores – making further savings. Indeed, the ongoing sub-prime recession, rising fuel prices as the pound sterling declined internationally, and a run of bad weather combined to reduce the volume of trade made through large, remote, car-based stores. Note, too, that whilst our proposed changes may be immediately feasible for branded goods and unbranded fresh food, own-label products cause a quite specific problem as they can only be delivered to the 'owner' retailer. Indeed, own-label products are still growing as they are a particularly important market distortion whereby the 'owner' retailer makes exclusive profits. The pro-regional agenda was presciently explored by Hopzafel (1995) in the context, particularly of German Lander. Whilst Canadian provinces might offer a parallel, no functional sub-regions exist in England. Hopzafel's hopes for more pro-regional preferences (that would save road miles) may work in Germany – and indeed France or Spain – but would be hard to achieve

in England. Hopzafel's suggestion of informational databases of locally-available products is, however, a welcome and valid one. Indeed, in our Portsmouth sub-region, the University of Portsmouth is working with suppliers on a Smartphone App to identify such supplies. Other suppliers of mobile and online information can alert subscribers to their nearest small store. Overall, however, we sense that, in the years since Hopzafel's work, the anti-local EU integration agenda has been on the rise: as have similar pressures in Canada.

Whilst our initial analysis was based on numerical estimation of emissions, we can only conclude that any solutions must be both political and behavioural. We commend a reversion to a strong wholesale sector, more home cooking of real food, a reversion to seasonal food and menus, a more-regionally focused retail and supply system and a tightening of lax merger rules. Re-regionalising of proper food would have a notable effect on the patterns and aggregate demand for increasingly-expensive freight transport. Curiously, though, there is a wider parallel with our concerns. Much of our criticism focuses on low-price short-termist thinking that finds expression in Chicago-School competition mindsets. If the public mindset were to turn to the local, the fresh, the seasonal, many problems would be overcome. Finally we call again for more research on a wider basket of produce, recognising that here we have only considered one product.

#### Notes:

(1) Direct air travel distance from Nairobi, Kenya to Gatwick, UK is 6,800 km. Reference emission factor = 608 g CO<sub>2</sub> per tonne-km (long-haul air freight; Table 7f; DEFRA, 2011). The 130 km of road transportation from Gatwick airport to Andover RDC, and 113 km from Andover RDC to Portsmouth would add approximately 63 kg CO<sub>2</sub> per tonne of produce delivered. Direct local transportation of maximum 161 km from farm to Portsmouth. Reference emission factor = 259 g CO<sub>2</sub> per tonne-km (UK average for all rigs; Table 7e in DEFRA, 2011). If the produce was routed through a RDC prior to arrival in Portsmouth, then the amount of CO<sub>2</sub> emitted per tonne could be doubled.

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#### References

- Albright, L.D. and de Villiers, D.S., 2008. Energy investments and CO<sub>2</sub> emissions for fresh produce imported into New York State compared to the same crops grown locally. Final Report prepared for the New York State Energy Research and Development Authority, Cornell University, Ithaca, (NY), USA.
- Anon., 2009. Poland set for largest eco-greenhouse. November 26, 2009. Available online from <http://www.freshmarket.pl/en/news;n1314988168> (Accessed February 20, 2012).
- Anon., 2012. Seasonal calendar for fruits and vegetables for Western/Northern Europe. Available online from [http://na-nu.com/terfloth.org/kitchen/season\\_cal.pdf](http://na-nu.com/terfloth.org/kitchen/season_cal.pdf) (Accessed February 20, 2012)
- Bakan, J., 2004. *The Corporation: the pathological pursuit of profit and power*. Viking Canada, Toronto, Canada.
- Ballingall, J. and Winchester, N., 2008. Food miles: Starving the poor? Economic Discussion Paper No. 0812. University of Otago, Dunedin, New Zealand.
- Bentley, G., Hallsworth, A. G. and Bryan, A., 2003. The countryside in the City – situating a Farmers' Market in Birmingham. *Local Economy*, 18 (2): 109-120.
- Bomford, M., 2010. Getting fossil fuels off the plate. The Post Carbon Reader Series: Food, Post Carbon Institute, Santa Rosa (CA), USA.

Clarke, I., Hallsworth, A.G., Jackson, P., de Kervenoael, R., Perez del Aguila, R. and Kirkup, M., 2006. Retail restructuring and consumer choice 1: Long-term local changes in consumer behaviour: Portsmouth, 1980-2002. *Environment and Planning A*. 38: 25-46.

Department for Environment, Food and Rural Affairs (DEFRA), 2011. 2011 Guidelines to Defra / DECC's GHG Conversion Factors for Company Reporting. UK Department for Environment, Food and Rural Affairs. Available online from <http://archive.defra.gov.uk/environment/business/reporting/pdf/110819-guidelines-ghg-conversion-factors.pdf> (Accessed November 8, 2011).

de Kervenoael, R., Hallsworth, A.G., Elms, J. and Canning, C., 2010. The food superstore revolution: changing times, changing research agendas in the UK. *International Review of Retail, Distribution and Consumer Research*, \_\_: 135 - 146.

de Schutter, O., 2011. Observations on the current food price situation. Background note. UN Special Rapporteur on the right to food, Office of the United Nations High Commissioner for Human Rights. Geneva, Switzerland, January 21, 2011. Available online from [http://www.srfood.org/images/stories/pdf/otherdocuments/20110124\\_background-note-food-price-situation\\_en.pdf](http://www.srfood.org/images/stories/pdf/otherdocuments/20110124_background-note-food-price-situation_en.pdf) (Accessed October 20, 2011).

FAOSTAT, 2012. Production - Crops. Food and Agriculture Organization of the United Nations, Rome, Italy. Available online from <http://faostat.fao.org/> (Accessed February 20, 2012).

Foster, C., Green, K., Bleda, M., Dewick, P., Evans, B., Flynn, A. and Mylan, J., 2006. Environmental Impacts of Food Production and Consumption. Final Report prepared for DEFRA. Manchester Business School, Manchester, UK. pp. 52-54.

Garnett T (2003), *Wise Moves Transport 2000 Trust* : London

Garside, B., MacGregor, J. and Vorley, B., 2008. Review of Food Miles, Carbon, and African Horticulture: environmental and development issues. COLEACP, Rungis (Val de Marne), France.

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Grupa Producentów Owoców i Warzyw "Gospodarstwo Ogrodnicze T. Mularski" Sp. z o.o. (Grupa Mularski), 2012. "Family" Tomatoes - miejscowość Świerkle. Różanki, Poland. Available online from <http://www.mularski.pl/index.php?str=2&ids=40> (Accessed February 20, 2012).

Hallsworth, A. G. , Lewington, T. and Hernandez, T., 2008. "...from my cold, dead land" - property dimensions of the WalMart growth strategy: US-Canada-UK. Paper presented at the Annual Conference of the British Association for Canadian Studies, Durham University, Durham, UK, April, 2008.

Hartwich, F., 2009. When food markets do not provide enough food. *Focus No. 1/09*. InfoResources, Zollikofen, Switzerland.

Herold, A., 2003. Comparison of CO2 emission factors for fuels used in greenhouse gas inventories and consequences for monitoring and reporting under the EC emissions trading scheme. Technical Paper 2003/10. European Topic Centre on Air and Climate Change Mitigation, Bilthoven, The Netherlands. 23 pp.

Hogan, L. and Thorpe, S., 2009. Issues in food miles and carbon labelling. ABARE Research Report 09.18, Australian Bureau of Agricultural and Resources Economics, Canberra, Australia.

Hopzafel , H., 1995. Potential forms of regional economic co-operation to reduce goods transport. *World Transport Policy & Practice*, 1: 34-39.

Kia Motors UK Ltd., 2012. Rio '1' 1.1 CRDi 74bhp 6-speed manual ISG. Available online from <http://www.kia.co.uk/new-cars/range/compact-cars/new-rio/emissions.aspx> (Accessed February 22, 2012). Lowest emission of all UK cars rated at 85 g CO2 per km.

Krznicaric, R., 2005. The limits of pro-poor agricultural trade in Guatemala: Land, labour and political power. Background thematic report for the Human Development Report 2005, United Nations Development Programme, New York (New York), USA.

- Lawrence, F., 2011. Spain's salad growers are modern-day slaves, say charities. *The Guardian*, February 7, 2011. Available on line from <http://www.guardian.co.uk/business/2011/feb/07/> (Accessed July 20, 2011).
- Legge, A. et al., 2007. Mapping different supply chains of fresh produce exports from Africa to the UK. *Fresh Insights No. 7*. International Institute for Environment and Development, London, UK.
- Lines T (2001) *Making poverty: a history* London Zed books Chapter 5 pp 104-117
- Montero, J.I., Antón, M.A., Torrellas, M., Ruijs, M. and Vermeulen, P. 2011. Environmental and economic profile of present greenhouse production systems in Europe. Deliverable 5, Final Report, EUPHOROS, September 2011.
- Potter, A., Mason, R. and Lalwani, C., 2006. Analysis of Factory Gate pricing in the UK. *International Journal of retail and distribution management*, 35(10): 821-834.
- Pretty, J.N., Ball, A.S., Lang, T. and Morison, J.L.L., 2005. Farm costs and food miles: An assessment of the full cost of the UK weekly food basket. *Food policy*, \_\_\_\_: \_\_\_\_.
- Roberts, G., 2012. Next stop, the Olympics: Urban farmers are digging for eco-victory. *The Independent*, January 8, 2012. Available online from <http://www.independent.co.uk/environment/> (Accessed January 8, 2012).
- Schmidt, F., 2011. Urban farming promise to slash food miles. *Deutsche Welle*, November 14, 2011. Available online from <http://www.dw-world.de/dw/article/0,,15525958,00.html> (Accessed November 14, 2011).
- Smith, A., Watkiss, P., Tweddle, G., McKinnon, A., Browne, M., Hunt, A., Trevelen, C., Nash, C. and Cross, S., 2005. The validity of food miles as an indicator of sustainable development. Final report (No. ED50254; Issue 7) produced for DEFRA, July, 2005.
- Smith, A. and MacKinnon, J. B., 2007. *The 100-Mile Diet: A Year of Local Eating*. Random House, Toronto, Canada. 272 pp.
- Smit, P.X., and van der Velden, N.J.A., 2008. *Energiebenutting Warmtekrachtkoppeling in de Nederlandse glastuinbouw*. LEI-rapport 2008-019, LEI, onderdeel van Wageningen UR, Den Haag, Nederlands.
- Soil Association, 2007. Should the Soil Association tackle the environmental impact of air freight in its organic standards? *Air Freight Green Paper: a basis for discussion*. UK Soil Association, Bristol, UK.
- Sustain, 1994. *The Food Miles Report*. Sustain: The alliance for better food and farming, London, UK. This document was updated and re-issued in 2011 as "The Food Miles Report: the dangers of long-distance food transport".
- Tello, J.C., 2002. Tomato production in Spain without methyl bromide. *Proc. International Conference on Alternatives to Methyl Bromide*, Sevilla, Spain, March 5-8, 2002. Available online from [http://ec.europa.eu/clima/events/0039/tomatoprod\\_spain\\_en.pdf](http://ec.europa.eu/clima/events/0039/tomatoprod_spain_en.pdf) (Accessed February 22, 2012)
- van der Velden, N.J.A. and Smit, P.X., 2010. *Energiemonitor van de Nederlandse glastuinbouw 2009*. LEI-rapport 2010-091, LEI, onderdeel van Wageningen UR, Den Haag, Netherland.
- Vivas, E., 2009. *Food Crisis: causes, consequences and alternatives*. Centre for Studies on Social Movements (CEMS), Universitat Pompeu Fabra, Barcelona, (Catalunya), Spain.
- Whitelegg, J., 1997. *Critical mass: transport, environment and society in the twenty-first century*. Pluto Press, London, UK.
- Williams, A.G., Audsley, E. and Sandars, D.L., 2006. Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities. Main Report. DEFRA Research Project IS0205. Cranfield University, Bedford, UK. pp. 74-75.
- Wong, A., 2010. Food miles and localized vegetable production in the North Baltic region. *Proc. International Conference on Agricultural Engineering - AgEng 2010*, Clermont-Ferrand, France, September 6-8, 2010.

Wong, A., 2012. New Agriculture: an alternative means to provide enduring employment and food security for Martinique. Paper to be presented at the International Conference on Agricultural Engineering - AgEng2012, Valencia, Spain, July 4-8, 2012.

Wyle, A., 2008. Crop for the Shop. Mimeo notes available from the author: [alan.wyle@gmail.com](mailto:alan.wyle@gmail.com)



## Parental safeguarding children from road traffic: A global issue

Arlene Tigar McLaren and Sylvia Parusel

### Introduction

The World Health Organization's World Report on Child Injury Prevention (Peden et al., 2008) presents current thinking about various types of child injuries and how to prevent them. The Report intends 'to help transfer knowledge into practice, so that what has proven effective in decreasing the burden of child injuries in some countries can be adapted and implemented in others, with similar results' (p. xv).

For determining how to prevent road traffic child injury, the WHO Report draws mainly on western traffic safety discourses as a basis of knowledge for low- and middle-income countries. The reliance on western traffic safety discourses involves several major problems: it does not come to terms with the automobility system and, indeed aids and abets it, even if unintentionally; it foists on other countries western views about parents and children; and fails to reflect on many of the costs of the automobility system to parents (especially mothers) and children.

To pursue these arguments, this paper first discusses automobility and parental traffic safeguarding. Second, it demonstrates how parents practice traffic safety in a high-income country and the costs that they and their children have to bear. Third, it shows how the WHO Report's traffic safety discourses incorporate practices based on western middle-class ideals of parenthood and motherhood responsibility and supervision without taking into account the burdens for parents and children and the inappropriateness of these ideals. Our analysis suggests that for the sake of parents and children in countries around the world, land and transportation planners need to develop alternative designs to auto domination.

### Automobility and parental traffic safeguarding

The automobility system, which is composed of motor vehicles, component parts, energy sources and road networks as well as cultural symbols and emotional attach-

ments, has radically altered how people live and move about (Urry, 2004). Auto domination is well established in high-income countries where spatial design caters to road systems and 'where drivers are accustomed to taking precedence over other road users' (Lang et al., 2011: 513). As countries develop automobility, they acquire some of its benefits and many of its troubles (Conley and McLaren, 2009). Such troubles include the disenfranchisement of those who do not drive due to age, ability, income or lack of opportunity (Freund and Martin, 1993) and the threat of death and injury especially in the case of vulnerable populations such as children.

Fortunately, most parents in automobilized environments are spared the trauma of their child being hit by a motor vehicle as a pedestrian or cyclist or being in a motor vehicle that collides with another. Parents are not, however, spared the anxieties of fearing for their children's lives on auto-saturated streets. Because of their fears, parents often go to great lengths to protect children from motor vehicle collisions and compensate on their behalf by removing them from traffic risks. If it were not for such parental safeguarding, children's traffic death and injury would be much greater than they already are (Hillman et al., 1990; Adams, 1993).

Several bodies of literature that examine parental views and/or practices about children's spatial mobility provide a preliminary understanding of parental traffic safeguarding (Hillman et al., 1990; Adams, 1993; Dixey, 1999; Thomsen, 2005; Murray, 2008; Collins et al., 2009). Such studies, however, do not focus on how parents practice traffic safety in their everyday lives in specific automobilized contexts and the impact these practices have on the parents.

To conceptualize parental traffic safeguarding practice, we define it as a form of everyday parental (or guardian) protection of and responsibility for young children's spatial mobilities that are threatened by auto domination of public roads<sup>1</sup>. Parental traffic safeguarding can take place in the home (keeping children inside away from traffic), in playgrounds

<sup>1</sup> See McLaren and Parusel (2012) for further discussion.

and other places (containing children's mobilities in adult organized spaces), in motor vehicles (driving children to protect them from traffic; using safety devices to restrain children as passengers), and in motorized streets (guarding children as pedestrians and bicyclists from traffic).

Parental traffic safeguarding practices are complex and play out differently in time and space. For instance, a parent who made a strategic choice in the past to live in a particular location to avoid traffic may currently not see traffic as dangerous (Dixey, 1999). This example suggests, furthermore, that families self-regulate to avoid traffic dangers and recalls arguments that parents compensate for dangerous roads on behalf of their children by removing them from traffic (Hillman et al., 1990; Adams, 1993).

As a discursive framework, parental traffic safeguarding defines the extent to which children should be protected and how they should be protected, who is responsible for protecting them from harm, and who is to blame if a child is injured. In the early decades of the twentieth century as automobility claimed urban streets in Australia and the United States, traffic safety was a central point of conflict. Its discourses, which eventually shifted the primary responsibility for road safety away from drivers and onto vulnerable road users, became a foundation to the automotive city (Bonham, 2006; Norton, 2008). These discourses construct parents (or guardians) as responsible for protecting children and as having to accommodate themselves to motorized traffic (Hillman et al., 1990; Kullman, 2009). If children are harmed, traffic safety discourses often hold mothers responsible (Jain, 2004), as part of broader gender-related western prescriptions that mothers and other female caregivers should primarily provide for children's safety and survival (McLaren and Parusel, 2012).

Parental traffic safeguarding is a key component of domestic care, which involves embodied practices that are deeply felt. Such experiences recall Sheller and Urry's (2006: 216) argument about the importance of understanding the 'corporeal body as an affective vehicle through which

we sense place and movement, and construct emotional geographies'. Parental traffic safeguarding experiences also allude to the politics of mobile practice, suggesting such questions as: 'How is mobility embodied? How comfortable is it? Is it forced or free?' (Cresswell, 2010: 21). Our exploration of parental traffic safeguarding outlines some of the ways that it is embodied, uncomfortable and forced.

In what follows our paper illustrates how parental traffic safeguarding practices are a vital foundation to automobility, although variable in local and national contexts. We show how the practices differ within a high-income country according to the type of traffic, socio-economic characteristics of neighbourhoods and norms of parenting. The practices have uneven consequences that are linked to such social inequalities as generation, gender and social class, and are particularly burdensome to specific groups. They discipline parents (especially mothers) to be forever vigilant in ensuring children's safety and immobilize children, denying them the ability to freely use, explore and travel in their local environment.

### **Parental traffic safeguarding practices**

We conducted two in-depth case studies in Vancouver, Canada – one school based and the other neighbourhood based – to explore the subjectivity and lived experiences of parents as they seek to protect young children from traffic in specific social, spatial and automobilized contexts.<sup>2</sup> The school study compared parental traffic safeguarding practices in protecting children's mobility between home and school at two elementary (primary) schools: the west side (WS) school is located in a traditionally middle-class neighbourhood; the east side (ES) school is located in a traditionally working-class neighbourhood. This comparison of schools links social class to neighbourhood characteristics. While each school neighbourhood is heterogeneous, the socio-economic differences between them are striking. For example, the average household incomes are much higher in the west side than east side neighbourhood. Social diversity (e.g. ethnicity; family formation) is much greater in the east side than west

<sup>2</sup> The names of neighbourhoods, schools and parents are anonymized.

side neighbourhood. Both neighbourhoods are highly automobilized but have distinct road systems that are linked to social class. Between June 2007 and Sept 2008, we interviewed 12 parents (including a focus group of six mothers) at the WS school and 10 parents at the ES school. We also collected local documents and observed traffic sites at the two schools.<sup>3</sup>

The neighbourhood study, which is ongoing, compares parental traffic safeguarding and mobility practices in four Vancouver neighbourhoods that vary according to socio-economic characteristics, road systems and urban density. This study is conducting interviews with parents who have young children up to 12 years old and thus far includes ten participants who live in two working-class neighbourhoods.

The school and neighbourhood studies illustrate how parental traffic safeguarding is a consuming daily practice in auto-dominated environments, and is fundamental to protecting children and facilitating traffic flow for the benefit of automobility. Parents have good cause to be anxious about motorized traffic danger; they invest considerable time and energy in protecting children; mainly mothers are involved in the burden of such safeguarding care, which constrains and disciplines both parents and children.

#### *The west side (WS) school*

The middle-class WS school is located in an area that includes green boulevards and parks separating pedestrians and bicyclists from traffic. Nonetheless, the local roads are dangerous, especially during rush hour and school drop off and pick up times. Interviewed parents voiced concerns about the dangerous streets. Kate, who had children aged five and seven and regularly walked with them to and from school, recounted her anxieties about close calls at a nearby intersection. She worried about when her children are older and will want to walk to school on their own without adult escort:

Top of the hill...with speed, people come down; it's unbelievable...about a month ago there was a nasty accident there between a car and truck....

<sup>3</sup> For further discussion of the study's methods and neighbourhoods' characteristics, see McLaren and Parusel (2011).

And I think just within my group of friends...we're kind of thinking ahead of, you know, one day they're going to want to walk to school, with a group of them, and no I don't feel safe.

Despite the fact that this intersection is one of the 'worst' in Vancouver for motor vehicle crashes and injuries (Skelton, 2010), it does not provide crosswalks or traffic lights to protect non-motorized mobilities.

Parents were also concerned about the concentration and chaos of school entrance traffic. For example, Bridget who drove her 10 year old daughter to school in the mornings said: 'Yeah, everyday, if I'm there in the peak time, everyday it's bad...But it seems in a way to be worse in the morning, because people are rushing to get there and so they seem to take less care'. As other research notes, traffic chaos at the school gate concerns many parents (Lang et al., 2011).

At the WS school, parental traffic safeguarding practices were highly gendered involving mostly women (as mothers, nannies, grandmothers, friends, etc.) and sometimes men. Because of middle-class advantages, many WS school mothers had the time and resources to be involved with their children's education including traffic safeguarding. For example, the WS school's traffic safety committee was composed entirely of mothers. They organized daily safety procedures at the school entrance and promoted alternative travel to the car (Parusel and McLaren, 2010).

#### *The east side (ES) school*

Although traffic surrounding the WS school was dangerous for young children, the road system was even more treacherous in the ES school catchment area, which has four times as many 'worst intersections' of traffic crashes and injuries as the WS school catchment area (Skelton, 2010). The fact that two truck routes carve their way through the ES school area reflects a broader pattern in Vancouver in which truck routes are more prevalent in working-class than middle-class neighbourhoods<sup>4</sup>. This location in Vancouver of truck routes is similar to freeways in most North American cities that are routed through

<sup>4</sup> See truck route map (City of Vancouver 2009).

low-income neighbourhoods (Freund and Martin, 1993)<sup>5</sup>. Because of the problems of truck routes running through residential neighbourhoods, Vancouver east side parents have recently formed a group – Advocating for Container Trucks off Residential Streets (ACTORS). The group notes that 19 schools border the truck route at issue and that ‘pedestrian lights and crosswalks don’t seem to be effective for trucks carrying large loads, which make it difficult for them to stop’ (O’Connor, 2011).

Parents at the ES school told us about the dangers of the heavy trucks and speeding motor vehicles that are close to the school. Christina said: ‘Some of the areas don’t have lights, or they just have to cross, or it’s just a stop sign.... It’s not just cars, it’s these big trucks just going quickly.... So, you can’t even tell your child to wait until the light turns red. You really have to be super cautious’. Besides the greater presence of heavy trucks, the local streetscape differs from the WS school in having less green space – fewer large trees, sidewalk boulevards and parks – that separate non-motorized from motorized mobilities. As a result of the dangerous road system, the ES school parents in our study did not trust the traffic infrastructure and worried about allowing their children to cross the streets on their own. For example, Kerry, who had children aged five and ten, said:

It’s just so hard to just be able to let them just go. You know, across the street by themselves...you’re just feeling like okay, if they didn’t just watch that one time, ...you’re always going to put yourself there, like, if I was there, that wouldn’t have happened... everything is just scary about it.

The ES school parents in our study were anxious and felt compelled to curtail their children’s activities and to be constantly on guard, whether they drove their children to school, escorted them or allowed them to walk or bike on their own. More fathers participated in interviews and more men (fathers, grandfathers, etc.)

<sup>5</sup>In the 1960s and early 1970s a low-income, ethnically mixed east side coalition led mainly by women successfully resisted proposals to build a freeway through their residential neighbourhood (Lee, 2007). As a result, Vancouver does not have a freeway that runs into or through the downtown area.

appeared to be involved in chauffeuring and escorting at the ES school site than at the WS school site. In contrast, to their WS school counterparts, the ES school mothers in our study were more actively engaged in the labour force and some had shift work. Traffic-safeguarding practices were less sharply delineated along gender lines at the ES than the WS school, suggesting that, while gender is powerful, it is also fluidly organized and negotiated.

As a crucial element of parenting in automobilized contexts, traffic safeguarding was highly routinized and institutionalized at the two schools. For parents, it required planning, organization, time and vigilance. For children, it resulted in the containment of their mobility whether they were chauffeured, escorted or had to stay on sidewalks and cross at intersections. The comparative study reveals in addition the ways in which traffic risks vary in specific contexts. The truck routes that sever the ES school neighbourhood create an especially threatening environment to children’s mobility and a high level of parental anxiety about their safety. The two neighbourhoods also differed in the ways that gender and social class interacted. Gender structured parental traffic safeguarding as primarily mothers’ responsibility more at the WS than ES school and parents negotiated gender according to specific socio-economic circumstances.

### *Two neighbourhoods*

The preliminary results of the second study are based on interviews with parents, mostly mothers, from two working-class Vancouver neighbourhoods (as the study proceeds, it will include two middle-class neighbourhoods) who have children up to 12 years of age. The preliminary results underscore findings of the school study in showing how auto domination contributes to parental traffic safeguarding practices with responsibilities that are burdensome, anxiety provoking, and gendered. The results also reveal in detail the complexities and encumbrances of parents traveling with very young children as they protect them from traffic.

Catherine who had five children, one of whom was four years old and the other

was eleven months, described the main street in her neighbourhood as similar to a 'highway': 'It's like a highway there. People try to race to get, before the lights turn. Or they make a turn to try to butt in. And sometimes they're so busy, is what I could see, they don't see the pedestrian, right'. Walking in the local area with her young children was time consuming and required negotiating numerous dangerous intersections. She said: 'You have to stop a lot. And you have to stop and let them know that you have to look this way and look that way'.

Raveena spelled out the strategies in walking with her four year old child and other children in her day care to keep them safe: 'Yeah, make sure the seat belt is on in the stroller, they have to go in the stroller, I have to keep watching on the lights, kind of thing. I warn him not to run on the road, always on the sidewalk, make sure the kids don't run on the roads'. This example reveals the complexity of safeguarding young children pedestrians from traffic that includes: being ever present with them as they travel; never letting them out of sight; not allowing them to explore, play or run around; using strollers with seat belts to constrain their movement; keeping track of traffic lights; warning children; and making sure they stay on sidewalks and do not run on the roads.

Such strategies, which discipline not only children but also parents, recognize that traffic threats are forever present in reality and in memory. Parents are largely successful in preventing traffic injuries, but not necessarily close calls, which may never be forgotten. Raveena recounted a close call that had happened a year ago and the distress she had experienced was evident in her frightened facial expression and the agitated gesturing of her arms during her discussion:

He was three years old....the flashing light it goes red and he crosses the road and I was coming behind him with three kids, and I was calling, "Stop, stop, stop, Jamail, stop!"....And he crossed the road. And by the time I get to the road, it's green!....The cars are coming and I keep calling, "Stop, stop, stop. don't be scared, I'm com-

ing". That's a very bad scene.

Parents with whom we talked protected their traveling children using such various means as the body (shielding children from dangerous traffic), technologies (text messaging), and temporarily passing on the care of younger siblings to older, more traffic-competent children. Parents also had to negotiate with children who resisted having their mobility constrained or monitored. For example, Julia vividly portrayed her negotiated practices with her daughter Robin who was aged 12 and wanted to walk on her own to school:

I usually text her [Robin] and ask, I get her to text me on the cell phone to let me know she's okay or her older sister would like kind of follow behind her and follow her to make sure she's okay. But she knows when her sister's [Tara] following her...And she calls me after school and she goes, "Mom, why was Tara following me?" She gets really upset if anybody follows her.

As children become more independent, parents' anxieties about traffic risks shift rather than disappear in negotiating with their children about: when they are old enough to stay on the sidewalk by themselves, walk on their own to school, or ride in a car driven by themselves or someone of their own age.

What do these case studies reveal? They illustrate the ways in which automobility in a local western context imposes on parents the necessity of restricting their children's mobility. What may seem natural – mothers keeping their children safe – is forced upon them as key components of domestic responsibilities. Parental traffic safeguarding practices discipline parents (especially mothers) and children; they are particularly anxiety provoking in socio-economically disadvantaged neighbourhoods. The point of this small-scale analysis is to show that automobility on the ground imposes real costs, which must be kept in mind as we shift to a large-scale analysis to examine international traffic safety discourses.

## International parental traffic safeguarding discourses

The degree of automobility and the forms it takes vary locally and nationally. Although some cities in high-income countries may have reached 'peak car use' and are no longer being built around cars (Newman and Kenworthy, 2011), many low- and middle-income countries are expanding their use. For example, between 1994 and 2004, world motor-vehicle registrations increased 18%. In the US they grew 5%; in many other countries they grew far more rapidly, for example: India 57%, Eastern Europe 139%, and China 163% (Martin, 2009). Despite the fact that street spaces in low- and middle-income countries are increasingly reserved for high-speed, individually owned motorized vehicles (eg. cars, trucks, mini-buses), most people use less dominating modes of mobility (eg. walking, bicycling, animals, carts or scooters) or public transport (Cervero and Mason, 1998). Nonetheless, among low- and middle-income countries child road traffic injuries pose a growing public health issue.

Globally, over one-quarter of a million children (aged 0–19 years) are reported killed annually in traffic crashes and an estimated 10 million children are seriously injured or disabled (Peden et al., 2008). Since less-resourced countries in the world arguably have the highest rates of traffic injuries and fatalities and seriously underestimate the extent of the problem due to incomplete data, the true burden of deaths and injuries is likely far greater (Ameratunga et al., 2006). The WHO Report on child injury prevention (Peden et al., 2008) predicts that over the next 15 years rapid motorization will double the current annual incidence of children's traffic deaths and injuries in India and China. Studies also show that social class and income are key determinants of child traffic injury risks. Although low- and middle-income countries in 1998 together owned about one-third of the world's motor vehicles, they accounted for more than 85% of child road traffic deaths (Nantulya and Reich, 2003). Similarly, in high-income countries such as Britain, the US and Canada, children in the most deprived neighbourhoods have up to four times higher risk of pedestrian injuries than children in the least deprived neighbourhoods (Laflamme et al., 2010).

The WHO Report on child injury prevention (Peden et al., 2008) is an important document that brings to world attention the public health issue of child road traffic injuries. However, the danger of such a report is when it inadvertently draws upon western traffic safety discourses and frames the discussion in a way that aids and abets automobility. This section analyzes the WHO Report (Peden et al., 2008) to illustrate how it portrays parents (especially mothers) as responsible for protecting children from traffic harm – blaming those who do not adhere to a western ideal – and constructs children as requiring supervision in their daily mobility, without taking into account many of the costs to parents and children.

The WHO Report employs the Haddon Matrix, the most common paradigm in the western injury prevention field, to identify risk factors for road traffic crash injuries among children. According to the Report, one of the major pre-event risk factors is the socio-economic environment, which consists of: 'poverty; single-parent family; large family size; poor maternal education; lack of awareness of risks among caregivers, childcare providers and educators' (Peden et al., 2008: 37). These risk factors draw attention primarily to the responsibility of parents and caregivers for preventing child road traffic injuries. Although the Report does not analyze the gender of caregivers, its reference to 'maternal' education clearly identifies mothers as responsible and targets especially those who are poor, single parents and have large families as well as caregivers who 'lack awareness of risks'. Drawing on mainly western research, the authors take as a given that 'proper' family forms consist of small nuclear families – with mothers primarily responsible for caregiving, who are middle-class and well-educated. The Report focuses on the 'lack of adult supervision' as a major risk factor:

Lack of adult supervision has often been cited as a risk factor among children for road traffic injury. However, it is just one of several interrelated risk factors. There are a number of characteristics associated with parents or caregivers with a limited ability to supervise children. These include being a single parent, being a working parent, and being a parent affected by illness or depression....Such characteristics are found in families across the world, and are fairly independent

of the economic status of a country. Nonetheless, if there is adult supervision, the probability of a child incurring road traffic injury is significantly reduced. (Peden et al., 2008: 40)

The discussion assumes that parents or caregivers need to provide supervision and that specific family characteristics are necessary for preventing children from becoming traffic casualties – however applicable the characteristics are to non-western, let alone western, countries and at whatever cost to parents and children.

The WHO Report adopts a 'systems approach' that is promising, which 'moves away from the idea that children should adapt their behaviour to cope with traffic, in favour of an approach in which children's needs are addressed in the design and management of the whole road system' (Peden et al., 2008: 49). Yet, the discussion on child injury prevention is couched within assumptions about auto domination and the necessity of promoting traffic flow. Out of the Report's eleven recommended strategies, four are directly oriented to restraining young children and framing caregivers as responsible: reliance on child restraint systems; seat belts; bicycle helmets; and teaching knowledge and skills. Effective as these strategies may be in injury prevention – which remains a matter of debate (Adams, 2007) – they are elements of highly developed traffic safety regimes. Caregivers must learn to adapt to automobility, take on the responsibility of supervising children's mobility to protect them from motorized traffic, and buy whatever safety devices are necessary. The WHO Report in recommending high-income country safety strategies for low- and middle-income countries foists on the world a model of both the immobilized child and the gendered and middle-class female caregiver whose constant surveillance is required.

### **Conclusion**

This paper first examined parental traffic safeguarding experiences in a country where the automobility system is well established. It next explored how international traffic safety discourses that seek to prevent child death and injury in low- and middle-income countries have turned to

western parental models of responsibility and blame. These practices and discourses, we argued, are vital foundations to automobility. They contribute to the social constructions of childhood, parenthood and motherhood and are significant forms of power and discipline, albeit, that are negotiated and contested in everyday mobilities. Motorized streetscapes have troubling effects on parents and children increasingly at a global level. There is a clear need to challenge auto domination and relieve caregivers of some of the everyday threats posed by traffic.

Parental traffic safeguarding of young children in automobilized urban contexts is a complex everyday lived experience requiring strategic planning, coordinated action and skilled competence that is often encumbered, entailing emotional and embodied anxieties, discipline, time and effort. These strategies and practices are unequally distributed across genders, social classes and neighbourhoods. As part of domestic caring responsibilities, parental traffic safeguarding is a significant part of motherhood and is all the more burdensome to parents in socially disadvantaged neighbourhoods, where road systems sever communities and facilitate the speed of cars and heavy trucks. Our comparative school study suggests that the working-class ES school parents were not only socially and economically disadvantaged, but also spatially disadvantaged by a dangerous road system. Parental traffic safeguarding practices in highly-developed automobilized urban contexts, we argue, serve as a harbinger of what is at stake in countries that are laying the foundations of prioritizing automobility over other mobilities.

The analysis of the WHO Report (Peden et al., 2008) shows how it relies on western traffic safety and public health discourses to construct parental responsibilities for preventing child injury in low- and middle-income countries. The strategies reflect western disciplinary regimes in which parents (or guardians) supervise and restrict children's activities. The prevention measures contain specific notions about mothers' responsibilities for children's mobilities, children's needs to be confined to specific spaces and activities, middle-class

advantages in affording the time and money to spend on safety, and the requirement that parents and children adapt to traffic rather than the other way around. These traffic safety approaches fail to acknowledge the social inequalities and burdens attached to them and reflect a pervasive inevitability hypothesis of automobility (Henderson, 2009) in supporting the private car and the commercial vehicle over other mobility options.

This paper raises several key questions for research, policy and action: How do parents experience traffic safeguarding in various contexts around the world? In what ways is the protection of children from road traffic women's work? How do specific social discourses constitute parental traffic safeguarding and why? How can transportation policies be shifted away from the private motor vehicle that requires parents to compensate for the dangerous traffic and towards other forms of transport that enable children's independent mobility and their right to access their environment?

Tranter and Whitelegg (1994) argue that planners may be able to help communities to explore alternatives to car-dominated environments that prioritize human rather than motorized use of space and suggest that 'perhaps an important stimulus for the consideration of these ideas may be a concern for children's freedom and well-being' (p. 273). We add that another important stimulus may be a concern for parents' freedom and well-being. As part of this consideration, planners need to attend to the ways that gender is crucial in developing sustainable mobilities (Sheller, 2008).

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#### **References:**

Adams, J. (1993). Risk compensation and the problem of measuring children's independent mobility and safety on the roads. In Child, Transport and Quality of Life. M. Hillman (ed.), 44-58. London: Policy Studies Institute.

Adams, J. (2007). Seat belt laws – Repeal them? *Significance* (4)2, 86-89.

Ameratunga, S., Hajar, M. and Norton, R. (2006). Road-traffic injuries: Confronting disparities to address a global-health problem. *The Lancet* 367(6 May), 1533-40.

Bonham, J. (2006). Transport: Disciplining the body that travels. In *Against Automobility*. S. Böhm, C. Jones, C. Land and M. Paterson (eds.), 57-74. Oxford: Blackwell/Sociological Review.

Cervero, R. and Mason, J. (eds.) (1998). *Proceedings: Conference on Transportation in Developing Countries*. April 17-18. University of California, Berkeley.

City of Vancouver (2009). Truck route map (updated Jan 2009).cdr. [http://vancouver.ca/engsvcs/transport/traffic/pdf/english\\_map.pdf](http://vancouver.ca/engsvcs/transport/traffic/pdf/english_map.pdf). (accessed 12 March 2010).



- Collins, D., Bean, C. and Kearns, R. (2009). 'Mind that child': Childhood, traffic and walking in automobilized space. In *Car Troubles: Critical Studies of Automobility and Auto-Mobility*. J. Conley and A.T. McLaren (eds.), 127–143. Farnham: Ashgate.
- Conley, J. and McLaren, A.T. (eds.) (2009). *Car Troubles: Critical Studies of Automobility and Auto-Mobility*. Farnham: Ashgate.
- Cresswell, T. (2010). Towards a politics of mobility. *Environment and Planning D: Society and Space* 28, 17-31.
- Dixey, R. (1999). Keeping children safe: The effect on parents' daily lives and psychological well-being, *Journal of Health Psychology* 4(1), 45-57.
- Freund, P. and Martin, G. (1993). *The Ecology of the Automobile*. Montreal: Black Rose Books.
- Henderson, J. (2009). The politics of mobility: De-essentializing automobility and contesting urban space. In *Car Troubles: Critical Studies of Automobility and Auto-Mobility*. J. Conley and A.T. McLaren (eds.), 147-164. Farnham: Ashgate.
- Hillman, M., Adams, J. and Whitelegg, J. (1990). *One False Move...A Study of Children's Independent Mobility*. London: Policy Studies Institute.
- Jain, S.S.L. (2004). Dangerous instrumentality: The bystander as subject in automobility. *Cultural Anthropology* 19(1), 61–94.
- Kullman, K. (2009). Enacting traffic spaces. *Space and Culture* 12(2), 205-217.
- Kullman, K. (2009). Enacting traffic spaces. *Space and Culture* 12(2), 205-217.
- Laflamme, L., Hasselberg, M. and Burrows, S. (2010). 20 years of research on socioeconomic inequality and children's—unintentional injuries understanding the cause-specific evidence at hand. *International Journal of Pediatrics* 2010, Article ID 819687, 23 pages.
- Lang, D., Collins, D. and Kearns, R. 2011. Understanding modal choice for the trip to school. *Journal of Transport Geography* 19, 509-514.
- Lee, J-A.. 2007. Gender, ethnicity, and hybrid forms of community-based urban activism in Vancouver, 1957–1978: The Strathcona story revisited. *Gender, Place & Culture: A Journal of Feminist Geography* 14(4), 381-407.
- Martin, G. (2009). The global intensification of motorization and its impacts on urban social ecologies. In *Car Troubles: Critical Studies of Automobility and Auto-Mobility*. J. Conley and A.T. McLaren (eds.), 219-233. Farnham: Ashgate.
- McLaren, A.T. and Parusel, S. (2011). Parental traffic safeguarding at school sites: Unequal risks and responsibilities, *Canadian Journal of Sociology* 36(2), 161-184.
- McLaren, A.T. and Parusel, S. (2012). Under the radar: Parental traffic safeguarding and automobility. *Mobilities* DOI:10.1080/17450101.2012.659465.
- Murray, L. (2008). Motherhood, risk and everyday mobilities. In *Gendered Mobilities*. T.P. Uteng and T. Cresswell (eds.), 47–63. Aldershot: Ashgate.
- Nantulya, V.M. and Reich, M.R. (2003). Equity dimensions of road traffic injuries in low- and middle-income countries. *Injury Control and Safety Promotion* 10(1-2), 13-20.
- Newman, P. and Kenworthy, J. (2011). 'Peak car use': Understanding the demise of automobile dependence. *World Transport, Policy & Practice* 17(2), 31-39.
- Norton, P.D. (2008). *Fighting Traffic: The Dawn of the Motor Age in the American City*. Cambridge Mass.: The MIT Press.
- O'Connor, N. (2011). Vancouver truckers resigned to being booted off Nanaimo Street. *The Vancouver Courier* 9 August. <http://www.vancourier.com/news/Vancouver+truckers+resigned+being+booted+Nanaimo+Street/5229943/story.html#ixzz1opYsJcT2> (accessed 1 March 2012).

Parusel, S. and McLaren, A.T. (2010). Cars before kids: Automobility and the illusion of school traffic safety, *Canadian Review of Sociology* 47(2), 129–147.

Peden, M. et al. (eds.) (2008). *World Report on Child Injury Prevention*. Geneva: World Health Organization.

Sheller, M. (2008). Gendered mobilities: Epilogue. In *Gendered Mobilities*. T.P. Uteng and T. Cresswell (eds.), 257-265. Aldershot: Ashgate.

Sheller, M. and Urry, J. (2006). The new mobilities paradigm. *Environment and Planning A* 38, 207-226.

Skelton, C. (2010). Metro Vancouver's most dangerous intersections. *The Vancouver Sun* 11 September. <http://maker.geocommons.com/maps/22280>. (accessed 11 September 2010).

Thomsen, T.U. (2005). Parents' construction of traffic safety: Children's independent mobility at risk?, In *Social Perspectives on Mobility*. T.U. Thomsen, L.D. Nielsen and H. Gudmundsson (eds.), 11-28. Aldershot: Ashgate.

Tranter, P. and Whitelegg, J. (1994). Children's travel behaviours in Canberra: Car-dependent lifestyles in a low-density city. *Journal of Transport Geography* 2(4), 265-273.

Urry, J. (2004). The 'system' of automobility. *Theory, Culture & Society* 21(4/5), 25–39.