World Transport Policy & Practice

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Abstracts and keywords

How many shall live? How many shall die? Deaths resulting from the trans-Israel highway and alternatives: a risk assessment
G. Ginsberg, E. Fletcher, E. Ben-Michael, and Elihu D. Richter
KEYWORDS: Israel, Road construction, Deaths
"... When dealing with maladies that kill or maim ... one must risk embarrassment to contribute to the welfare of fellow human beings ..." (Robertson, 1992). At Public Inquiries in many countries into new road construction, it is usual for the promoters to claim that building the road will save lives. Israel is experiencing this rhetoric at present. The truth is somewhat different. New road construction is certain to lead to more carnage, increased mortality and additional disability. Here, Route 6, a six-lane dual carriageway (3 lanes in each direction) is put to the test.

Investment in Transport Infrastructure: Have the EU initiatives promoted their balanced and rational distribution?
Constantinos I. Chlomoudis and Athanasios A. Pailis
KEYWORDS: EU transport policy, infrastructure investments, Europe, Greece
The achievement of sustainable mobility and the completion of a unified trans-European transport network are two main targets of the European Union's (EU) Common Transport Policy. The selective modal distribution of investment in transport infrastructure is among the factors that can facilitate their fulfilment. Specifically, the fast modernisation of the currently underdeveloped and environment-friendly rail and maritime transport modes is essential. However, the substantial financial involvement of the EU has not promoted the balanced and rational distribution of investment in transport infrastructure within Europe. This is particularly evident in the case of Greece, where under investment and mono-modal priorities had characterised the national level policies. The emerging EU financial contribution has not managed to alter this unsustainable policy.

Transport and Health – a biomedical perspective
Dr Colin Bannon and Alex Costello
KEYWORDS: Traffic, Air pollution, Inequality, Road traffic accidents, Motorisation
Global motorisation has become a major health problem. This is not only due to rapidly escalating road traffic accidents but also to the contribution of vehicle exhaust emissions to heart attacks, strokes and respiratory disease as well as the indirect effect of low quality living environments on levels of mental and physical fitness. Second only to tobacco smoking, motorisation has become the worlds most compelling health problem.

Wrestling with the Octopus - New approaches to tackling traffic and sprawl
Lilli Matson
KEYWORDS: Traffic, Urban sprawl, U.S.A., U.K.
At both sides of the Atlantic Ocean urban sprawl is characterised by many of the same features. Governments in both Britain and the U.S.A. are tackling it with various policy instruments in the form of carrots and sticks, although the balance is open to question.

Car Sharing: Breaking out of the Transportation Trap
Richard Katzev, Ph.D.
KEYWORDS: Car sharing, Mobility
The history and present status of the car sharing mobility service is reviewed, with emphasis on developments in Western Europe and North America. Car sharing is viewed as an effective response to the rising costs and increasingly serious transportation problems created by private automobile transport. We note briefly evidence on the mobility behaviour of members of car sharing organisations and conclude by describing the promising future of a mobility service devoted to the concept of sharing cars.

Alternative Fuels, Alternative Drive Lines - The Route to Improvements?
Dr.-Ing. Rudolf M. Petersen
KEYWORDS: Alternative fuelled vehicles, fuel efficiency, global warming
Given the negative effects of increased Carbon dioxide emissions (and a limited fuel supply) it is necessary to develop alternative fuels for use in passenger transport. In the short term, however, increased fuel efficiency is more achievable and much more important. In addition, it is vital that commuter transport strategies are developed and implemented.

Changing industry behaviour: the role of prices and regulations
George Callaghan
KEYWORDS: Price mechanism, legislation, regulation, modal shift
The role of the price mechanism in changing and controlling behaviour is becoming increasingly popular, particularly in the field of transport. This article uses data from transport managers to argue that the power of the price mechanism is limited and that legislation and regulation are required to shift product from road to alternative modes.

Children's journeys to school - new data and further comments
Mary Sissons Joshi, Morag MacLean and Wakefield Carter
KEYWORDS: UK/Oxfordshire, Children, Local journeys, Cycling
This paper addresses a debate about children's journeys to school previously published in this journal in 1995. The parents of 315 children aged 7-11 in Oxfordshire were surveyed about their children's travel freedoms. The data are discussed in the context of current debates about transport, attitudes and lifestyle.

When is a car NOT a car?
Tracey Axelsson
KEYWORDS: Car sharing, Canada, Co-operatives
Co-operative Auto Network, as the name suggests, is a car sharing operation in Vancouver, Canada. Most members have dispensed with a car and use the co-op to provide them with private mobility as and when they need it.
THE year 1997 has been a good year for the transport debate in the U.K. Over 400 members of parliament have signalled their agreement with the aims of the Road Traffic Reduction (U.K. Targets) Bill which will be voted on in the House of Commons at the end of January 1998. There has been a major consultation on the future shape of U.K. transport policy initiated by the new Labour government and a new policy document is expected in the spring of 1998. These developments are part of a rising tide of expectation that there will be a significant shift in transport policy towards less traffic, greater accessibility and a cleaner, healthier environment.

Traffic reduction is the key to sustainable transport policies. Sustainable policies and rhetoric that do not address the strong rates of traffic growth, particularly in the developing world, cannot deliver the promises made at Rio and Kyoto. The higher levels of awareness of transport issues and the need for radical new directions may yet prove to be false harbingers of a new approach.

Developments around the world in terms of actual political decisions and cash allocation are still at variance with the rhetoric. The U.K. government has adopted a language consistent with environmental and sustainable transport commitments but has also approved the Birmingham Northern Relief Road. The state of Victoria in Australia is committed to major freeway construction, as is Israel and the European Union. In all cases the policy documents and the language have run ahead of the reality and politicians are still locked into a 1960s mindset of cheap transport, economic growth and paying lip service to the principles of ecological responsibility and efficiency.

In this issue of WTPP we give attention to some of the ideas that, in a very practical sense, are working towards solutions which are ecologically and economically efficient. Two papers on car-sharing (Axelson and Katzov) reveal the extent to which it is possible to arrange lifestyles and transport investments so that high levels of accessibility are maintained as car ownership falls. This is an important traffic reduction strategy in which the car plays a part but does not need to become the cherished personal possession that then spills over into dependency and use for the shortest and most inappropriate journey purpose.

Rudolf Petersen evaluates the role of alternative fuels in transport strategies. Great caution is required with any strategy that leaves the bulk of the system in the same disorganised condition as before, as is the case with cars and their space requirements and speed characteristics. Nevertheless, alternative fuels can reduce pollution on the streets.

Lilli Matson and Colin Bannon remind us of the land use and health impacts of our transport systems and car dependency. The cumulative impact of traffic on the health of children, elderly and infirm people globally and on the extent to which are willing to sacrifice vast tracts of agricultural land to new developments are still inadequately incorporated into decision-making systems for transport.

No discussion of health would be complete without reference to the carnage caused by traffic. We will start the next millennium with a tally of 30 million deaths on the roads of the world. Overlooking for the moment the deliberate, primary purpose and killing efficiency of military hardware, road vehicles must hold the world record for death and destruction attributable to a single piece of technology. Ginsberg and his colleagues take us to the heart of this matter in linking death on the roads to the major road building efforts of the Israeli government. Their closing Talmud quotation deserves a place in every highway and vehicle engineering office in the world.

European Union policy is more contradictory than that of many individual countries if only because sustainable development has been elevated to a significant position in the 5th Environmental Action Programme. This is confusing because, as Chomoudis and Pallis show, EU policy on the ground is very different. Their discussion of transport policy in Greece reveals the emphasis on road construction and the widening gap between rhetoric and reality.

John Whitelegg, Editor
How many shall live? How many shall die?
Deaths resulting from the trans-Israel highway and alternatives: a risk assessment

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Abstract
"... When dealing with maladies that kill or maim ... one must risk embarrassment to contribute to the welfare of fellow human beings ..." (Robertson, 1992). At Public Inquiries in many countries into new road construction, it is usual for the promoters to claim that building the road will save lives. Israel is experiencing this rhetoric at present. The truth is somewhat different. New road construction is certain to lead to more carnage, increased mortality and additional disability. Here, Route 6, a six-lane dual carriageway (3 lanes in each direction) is put to the test.

Keywords
Israel, Road construction, Deaths

Introduction
Road deaths and injuries were not included in the cost-benefit analysis that was central to the approval of the trans-Israel Highway (Route 6). Its planners claimed there would be 'a large savings in accident (sic) costs as a result of the construction of the highway' (Trans-Israel Highway Company, 1994). This omission was highlighted by Garb (1997) in a comprehensive examination of the highway's cost-benefit analysis, which included a discussion of induced traffic phenomena, their implications for reduced time savings and the project’s increased health costs.

It is standard practice in many countries to value lives preserved through safer transport measures as part of the decision-making process on investments in roads, rail and buses (Garb, 1997). In the U.K., Germany and U.S.A. values between $0.9 and $7.0 million have been imputed to each life preserved by measures to reduce transport injury risks (T&E, 1993; Forkenbrock et al., 1993; Garb, 1997). This paper reports the results of a risk assessment on the impact of road deaths from Route 6 in the year 2010.

Subsequent work is needed to report impacts from air pollution.

Methods
We constructed a spreadsheet model, based on kilometrage and road death data from 1995 to estimate the system-wide toll of road deaths for year 2010, with and without the proposed trans-Israel Highway and to compare the difference. We compared the results with two other scenarios: one, in which the road was not built (Scenario I: Do Nothing) and a second, promoting sustainable transportation (Scenario II: freezing road construction, congestion pricing, introducing more buses and trains, providing dedicated bus and truck lanes, encouraging rail freight, lower speed limits (especially for trucks) and installing speed cameras). Estimates for Scenario II did not come from these calculations, but results from recent projects in other western countries. Our calculations were based on:

* A current annual toll of 550 dead;
* The empirically demonstrated relationship between the fourth power of increases in travel speeds and increases in death tolls;
* Projected estimated increases in kilometrage for the year 2010;
* Speed increases of 6 km/h induced by Route 6 and connecting roads from less congestion; and
* The "spill-over" or habituating effect of a raised maximum speed limit (110 km/h) on system-wide speeds on all roads (Schmidt and Tiffin, 1969; Mathews, 1978; Casey and Lund, 1987; 1992). Given that case fatality rose on all interurban roads following the increase in speed limits and travel speeds in Israel indicates that this effect has to be considered in risk assessments (Richter, et al., 1996; Barach, 1996). Indeed, research in other countries (and especially the U.S.A.) has shown that increasing speed limits leads directly to an increase in road deaths (Gallagher, 1989;

**Exposure - Kilometre**

Data sources were Central Bureau of Statistics (1996), the International Road Federation (1994) and the Trans-Israel Highway Company (1994). The model took into account effects of increased capacity (i.e., less congestion and increased system-wide speeds). Route 6 is expected to induce 6.6% more kilometres in the system, being half the extra road capacity that building Route 6 would create (SACTRA, 1994; Garb, 1997). The model (Table 1) was used to project the total vehicle kilometre in the year 2010 on urban roads, interurban roads and on Route 6 (Table 2).

**Speed and estimated death risks**

Data sources for speed (Richter, et al., 1996; Barach, 1996) also include trans-Israel Highway projections. Calculations of death risks were based on the findings (Nilsson, 1982; Gallagher, 1989) that non-pedestrian deaths vary with the fourth power of changes in average speeds (Table 3). Conservatively, we hypothesized that there would be no changes in pedestrian deaths, based on preliminary work on the effect of the increased speed limit on two major highways from 90 km/h to 100 km/h, on 1 November 1993. (Thereafter pedestrian death tolls rose from 230 to 236, because increases in Jerusalem offset reductions elsewhere).

**Route 6 itself**

On Route 6, the maximum speed limit will be increased to 110 km/h, and travel speeds of many vehicles will be much higher, as envisaged in a brochure (Trans-Israel Highway Company and Sonol Oil Co.), available from gas stations, which promises travel times of 30 minutes duration between Haifa and the Sharon area, a distance of 65 km, implying a speed of 130 km/h. In addition, it promises a journey of 40 minutes between Beer Sheva and “the central part of the country”. The distance involved is from 90 km to 110 km, implying even higher speeds! Even so, we assumed that the death rates on Route 6 per vehicle km will be lower by 41.7% compared to other interurban roads, based on comparisons of current death rates per vehicle km on current high speed and other interurban roads. This trend is seen even though rises in death tolls on high speed roads as well as other roads follow rises in speed limits and travel speeds. Box 1 presents calculations of the death tolls on Route 6 from this model and other calculations based on Israeli fast road and U.S. Interstate death risks.

**All interurban roads**

Baseline (1995) death rates for pedestrian and non-pedestrian, urban and interurban routes, per hundred million km (Table 1) were multiplied by expected kilometre in year 2010. The product was multiplied by

---

**Table 1: Model Parameters**

<table>
<thead>
<tr>
<th></th>
<th>Year</th>
<th>Interurban</th>
<th>Urban</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Vehicle km (millions)</td>
<td>1995</td>
<td>13,375</td>
<td>17,258</td>
</tr>
<tr>
<td>Annual Growth Rate</td>
<td>1995 - 2000</td>
<td>3.90%</td>
<td>3.90%</td>
</tr>
<tr>
<td>Annual Growth Rate</td>
<td>2000 - 2010</td>
<td>2.96%</td>
<td>2.96%</td>
</tr>
<tr>
<td>Average System Speed (km/h)</td>
<td>1995</td>
<td>58.5</td>
<td>22.0</td>
</tr>
<tr>
<td>Pedestrian Fatalities</td>
<td>1995</td>
<td>35</td>
<td>132</td>
</tr>
<tr>
<td>Non-pedestrian Fatalities</td>
<td>1995</td>
<td>291</td>
<td>92</td>
</tr>
<tr>
<td>Pedestrian Fatalities / 100 million km</td>
<td>1995</td>
<td>0.26</td>
<td>0.76</td>
</tr>
<tr>
<td>Non-pedestrian Fatalities / 100 million km</td>
<td>1995</td>
<td>2.19</td>
<td>0.53</td>
</tr>
<tr>
<td>Safety Factor on Route 6</td>
<td>2010</td>
<td>58.33 %</td>
<td></td>
</tr>
</tbody>
</table>

**Table 2: Kilometre, System Speeds and Spill-over Effects by Scenario**

<table>
<thead>
<tr>
<th>Extra Kilometre (million km)</th>
<th>1995</th>
<th>2010</th>
<th>2010 with R6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>17,258</td>
<td>25,716</td>
<td>26,893</td>
</tr>
<tr>
<td>Interurban</td>
<td>13,375</td>
<td>20,705</td>
<td>16,896</td>
</tr>
<tr>
<td>Route 6</td>
<td>0</td>
<td>0</td>
<td>6,673</td>
</tr>
</tbody>
</table>

**System Speeds**

Average system speed - Urban km/h | 22.0 | 20.0 | 19.6
Average system speed - Interurban km/h | 58.5 | 53.2 | 63.2
Average system speed - Route 6 km/h | 68.1 |

**Spill-over Effect**

Urban Pedestrian Fatality Increase | 0.00% | 0.00% |
Urban Non-pedestrian Fatality Increase | 6.35% | 2.60% |
Interurban Pedestrian Fatality Increase | 0.00% | 0.00% |
Interurban Non-pedestrian Fatality Increase | 27.03% | 24.10% |

**NOTE:** Assumes 5.6% extra induced km due to Route 6 in system by 2010

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**Box 1: Calculations of predicted death toll on Route 6**

**Based on the model in this paper**

291 passenger deaths on interurban roads + 13.36 bkm x 0.58 risk factor = 12.83 D/ bkm ... 12.83 D/bkm x 6.73 bkm/ly = 85 deaths per anticipated exposure on Route 6.

But on Route 6, the risk increases as the fourth power of speed rises relative to the entire system: (68.1/68.5 to the fourth power = 1.83) which gives 152 deaths.

**Based on death rates per vehicle kilometre on Israel’s fast roads**

(using 1993 speed limit = 90 km/h, and 1993 reported D/bkm rate = 7.7) ... 7.7 D/bkm x (110/90 to the fourth power = 2.22) x 6.73 bkm/ly = 115 deaths

**Based on death rates per vehicle kilometre on U.S. Interstate Highways**

In the U.S. D/bkm was 10.5, with a speed limit of 65 mph (105 km/h) ... 10.6 D/bkm x (110/105 to the fourth power = 1.20) x 6.73 bkm/ly = 85.6 deaths.

**Key:** bkm - billion vehicle kilometres; y - year; D - deaths
the fourth power of the ratio of new system-wide average speeds to current average speeds throughout the system to obtain death tolls. Higher average speeds result from congestion relief and "spill-over" - speed habitation from the higher travel speeds on Route 6, especially in off-peak hours. The estimated size of the spill-over effect (Table 2) is based on 2.6% and 24.1% increases in urban and interurban road deaths respectively, directly following the increase in the speed limit on 1 November 1993. These increases were presumed to apply to non-pedestrian deaths only (Table 3).

Death tolls - the model
We estimated changes in road death tolls both with and without Route 6 under four different combinations for 1995 and 2010:
- deaths from extra kilometer alone;
- deaths from extra kilometer plus congestion relief;
- deaths from extra kilometer plus spill-over effect; and
- deaths from extra kilometer plus congestion relief plus spill-over effect.

Other Scenarios not from the model
Building Route 6 was compared to Doing Nothing (Scenario I) and Alternative Strategies (Scenario II) (see Figure 1). The estimated tolls from the Scenario II "sustainable transportation" option come from the finding that death tolls fell by \( \frac{1}{2} \) to \( \frac{1}{4} \) when speed cameras were used in Australia and the U.K.

Results

Effects from Extra Kilometrage
Without Route 6, road death tolls could rise from 550 to a toll as high as 850, an increase of 300, during the period 1995-2010 solely as a result of extra vehicles generating additional kilometerage. But it is estimated that Route 6 would increase deaths by 85. These would be offset by 87 fewer pedestrian and non-pedestrian deaths as a result of decreased kilometerage on interurban and urban roads.

Effects from Extra Kilometrage plus Congestion Relief
Without Route 6, when congestion is taken into account, deaths drop by 185 - from 850 to 665, or 115 more than the current toll of 550. But with Route 6, the increase in system speeds, provided there is system relief, will raise road deaths from 848 to 997, an increase of 149, or 332 more than the situation without Route 6 and without congestion relief. This will happen because large increases in death tolls on Route 6 and interurban roads combined will offset a smaller reduction of deaths among urban non-pedestrians. The latter is a consequence of the small decrease in urban speeds in all cities combined.

Effects From Extra Kilometrage plus Spill-over Effect
Without Route 6, there will be no spill-over effect from its higher speeds (limit: 110 km/h; expected 90% travel speed: 120 km/h), and total deaths are 850. But with Route 6 and the spill-over effect alone, deaths rise to 990, or an increase of 140; of which 56 (40%) come from the spill-over effect on interurban roads other than Route 6.

Effects From Extra Kilometrage plus Spill-over Effect plus Congestion Relief
Without Route 6, there will be no spill-over effect from its higher speeds (Limit 110 km/h; expected 90% travel speed: 120 km/h). But with Route 6, the combined additive speed effects from congestion relief and the spill-over effect, especially among interurban non-pedestrians, will raise the toll by 142 from 997 still further to 1139 deaths, an increase of 474 deaths over the 665 fatalities in the non-Rout6 scenario.

<table>
<thead>
<tr>
<th>Table 3: Fatalities by type, cause and scenario (2010)</th>
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<tbody>
<tr>
<td><strong>Route 6 components</strong></td>
</tr>
<tr>
<td>------------------------</td>
</tr>
<tr>
<td>Extra kilometrage</td>
</tr>
<tr>
<td>With R6</td>
</tr>
<tr>
<td>Without R6</td>
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<tr>
<td>Difference</td>
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<tr>
<td>Increased speed effects (From Congestion relief) + Extra kilometrage</td>
</tr>
<tr>
<td>With R6</td>
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<tr>
<td>Without R6</td>
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<tr>
<td>Difference</td>
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<tr>
<td>Spillover + Extra kilometrage</td>
</tr>
<tr>
<td>With R6</td>
</tr>
<tr>
<td>Without R6</td>
</tr>
<tr>
<td>Difference</td>
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<tr>
<td>Spillover effect + Congestion relief + Extra kilometrage</td>
</tr>
<tr>
<td>With R6</td>
</tr>
<tr>
<td>Without R6</td>
</tr>
<tr>
<td>Difference</td>
</tr>
</tbody>
</table>
Does Spill-over Effect = Effect From Congestion Relief?
If the spill-over effect alone is the best estimate of increase in system speeds, then the added number of deaths (over and above the effect without Route 6), would be 140 and the total death toll would be 990. If only increases in system speeds come from the congestion effect, then the increase in the death toll would be 332 and the total death toll would be in the range of 997. The net increases in the death toll would be lower if there is extreme congestion from induced travel and massive speed regulation. Both would negate the road’s role in reducing travel times.

Discussion
‘How many shall live...how many shall die?’
Death tolls with and without Route 6.
The nationwide increase in deaths from Route 6 ranges from 332 (congestion effect only) to 474 (congestion plus spill-over effects) more than would occur with alternative scenario I (Do Nothing), in which Route 6 would not be built (year 2010; n = 850; after congestion slowdowns: n = 665). Route 6 could produce annual nationwide road death totals of 990 to 1139. If congestion relief and spill-over both result in the same system-wide increases in travel speeds, then the first estimate would be expected to be more accurate. Table 4 and Figure 1 summarise these projections.

With Route 6, congestion from induced travel and speeds less than those posited in the model could lower these estimates of yearly death tolls, but probably not to below 480 deaths. Without Route 6, another strategy (Scenario II) is estimated to provide a reduction in death tolls to under 200 per year now and under 300 per year in 2010, provided alternatives to private motor vehicles are introduced vigorously and effectively. These alternatives rely on freezing road construction, congestion pricing, introducing more buses and trains, providing dedicated bus and truck lanes, encouraging rail freight, lower speed limits (especially for trucks) and installing speed cameras.

With Route 6, most of the increase in the death toll comes from an increase in interurban occupant deaths as a result of induced speed from less congestion (n = 196) or the spill-over effect (n = 56), or both, combined, if the effects are additive. A further 152 deaths are expected to occur on Route 6 and its new connecting roads.

Eighty-five of these deaths are a result of the new kilometre induced by the availability of Route 6 itself (partly offset by a decrease on other interurban roads) and 67 deaths are expected from the increased speeds on Route 6 itself. These high death tolls partly result from the high mix of heavy and light vehicles, and the high death tolls for the latter in collisions with trucks.

Table 4 and Figure 1 present death tolls from, and differences between, Route 6 and alternatives in relation to two baselines: the current annual toll (n = 550) and the toll (n = 850; n = 665 after congestion) without Route 6 in 2010. With Route 6, the range of death toll estimates is 980 and 1139. Slower speeds could lower all the above tolls for scenarios without and with Route 6. But slower speeds after the road’s construction would undermine the stated reason for its construction: time saving from more speed.

The model is sensitive to changes in the estimates of both induced travel and rises in travel speeds, especially in interurban settings. If we assume that there will be an 11.35% induced kilometre (Trans-Israel Highway Company, 1994), then there will be 429 to 595 more deaths system-wide each year from Route 6, and not 332 to 474 more deaths, it there were only 6.6% induced kilometre.

Alternatives: Immediate Benefits, Fewer Deaths
An alternative policy for sustainable transportation, based on more mobility and speed control is suggested. The case for this policies reducing death tolls to less than 200
per year right now and less than 300 per year in 2010 is firmly based on 50% - 60% reductions in death tolls with recent U.K. and Australian speed camera projects (McDermott, et al., 1996; Leathley, 1997). Although speed cameras could also produce large drops in death even with Route 6, the effects are suggested to be less, and the death toll would be subtracted from higher baselines. Furthermore, the experience with the Prince Edward Toll Road in Canada suggests that there will be powerful (short-term) financial pressures to mitigate speed control for the road, despite the huge costs of road injury (Friedman, 1997).

**Is The Estimate Too High or Too Low?**

*Too high?*

Calculations based on comparisons with recent death rates on Israel’s fast roads and the U.S. Interstate highway system suggest that for Route 6, the toll of 152 deaths per year could be too high. Quite understandably, there is some intuitive resistance to the notion that just one more road, albeit a big long one with many lanes and high speed limits, should increase road death tolls by such large numbers throughout the entire transportation system.

But past work has shown that system-wide effects have already occurred in Israel following a less extreme measure: raising speed limits on 70 km of interurban roads from 90 km/h to 100 km/h, on 1 November 1993. This measure was found to increase road deaths by some 40 (from 487 to 525) as a result of system-wide rises in speeds by some 4% - 5% and case fatality by some 15% - 20%. The Governmental Commission (Livneh, et al., 1993) which recommended this speed increase was unable, apparently, to overcome this same intuitive resistance, despite its own citation of the peer reviewed literature which warned otherwise and the immutability of Newtonian Laws of Motion.

*Too Low?*

In the case of Route 6, the estimated death tolls could be too low if its construction specifications lock in cost cutting compromises on international standards (“value engineering”) which themselves are now considered to be inadequate, as pointed out by the Canadian Government (Hauer, 1997). If, for example, the road is designed for peak travel speeds of 120 km/h, and the speed limit is set at 110 km/h, as currently proposed, then, based on past observations in Israel by Barach (1996), there is good reason to expect that 120 km/h will be the median speed in the fast lane.

**Estimated Costs**

Average age of deaths from road deaths in 1995 was 38.6 years, meaning each road death cost 38.9 potential life years (Central Bureau of Statistics, 1996). Each death was valued at around $307,000 using the GNP method of valuing human life and a 4% discount rate as was used in the Route 6 planning report. Therefore, the 474 additional deaths in 2010 have mortality costs of around $146 million per annum. A higher valuation based on willingness-to-pay data would value mortality losses at around $538 million per annum. The costs of road deaths, plus those from moderate and slight injury, would substantially reduce the projected net worth of Route 6.

These estimates do not include the costs of injuries, from catastrophic chemical disasters and from possible extra air pollution generated by excess kilometrage.

Our assessments indicate that Route 6

<table>
<thead>
<tr>
<th>Table 5: Effect of induced kilometrage on death tolls</th>
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<tbody>
<tr>
<td><strong>Effects from</strong></td>
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<tr>
<td>-------------------</td>
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<tr>
<td>Extra Kilometrage</td>
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<tr>
<td>Difference</td>
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trades off tangible losses in human life and limb for esoteric and arbitrary valuations of increases in time savings. As already noted, injuries and deaths have been shown to rise exponentially as a function of the second power and fourth power respectively, of increases in average road traffic speeds. These exponential relationships, which are rooted in Newtonian Laws of Mass and Kinetic Energy, create formidable barriers to injury reduction when speeds increase. This means that with Route 6, there will be fewer deaths and injuries than predicted by our assessment only as a result of decreased speeds generated by increases in traffic density, i.e. from conditions which nullify the supposed justification for the road.

**Policy Implications: The alternatives**

We see that alternative solutions (Scenario II) are available without the expected large increases in road carnage from faster speeds produced by Route 6. In the U.S.A., for example, passenger rail is 18 times safer than private car travel (T&E, 1993). Another long run solution is the adoption of town planning modes that encourage the design and use of pedestrian routes, cycle paths and rail networks as safer alternatives to motorised vehicle trip generation (Fletcher and Garb, 1997). Shifting to safer modes which deliver mobility is preferable to relying on congestion to reduce road deaths. Freezes on road construction, dedicated bus and truck lanes, congestion pricing, introducing more buses and trains, encouraging rail freight, lower speed limits (especially for trucks), and electronic speed camera networks are the elements of an alternative policy which give immediate relief and reduce death and injury tolls immediately. Speed cameras have been shown to reduce road death tolls by 50% - 69%, while generating revenues that put detection and deterrence on a self-sustaining basis. The empirical findings which are the basis of Scenario II mean that there is a greater than 300% difference in yearly death tolls between the worst and best scenarios. For death, injury and disability, the risk assessments in this paper indicate that Route 6 is the worst scenario, and alternatives based on sustainable transportation packages are the best solution.

**Conclusion**

It is ironic that Route 6 will not only result in more loss of human life, Israel’s most precious resource, but will serve as the centrepiece of a transportation policy which increases dependence on energy imports. It is important to note that the Trans-Israel Highway Company, a state owned company, is implicitly endorsing future driver speeds exceeding current legal speed limits. By publishing such information for journey times, the company may be condoning drivers who exceed the speed limits. Such tacit approval for law breaking requires legal examination.

This exclusive focus on reduced travel times that result from road system speed increases is myopic and morally indefensible since it ignores the increases in deaths, injuries and disabilities that will be an inevitable consequence of reduced travel times. A policy of concentrating on reduced travel times from rises in system speeds ignores the consequential increases in road death and injury tolls and provides no comfort to the victims and their loved ones. Including the War of Independence in 1948, all subsequent wars involving Israel, and the many terrorist atrocities, the total killed by the bullet and the bomb is estimated to be between 18,000 and 20,000 victims. In contrast, on the roads of Israel from the foundation of the state in 1948 up to 31 December 1997, the total reported killed in motor vehicle crashes inside the Green Line is 19,927 (Central Bureau of Statistics, 1997). This figure does not include an estimated 3000 - 4500 persons killed outside the 1967 Green Line, whose deaths are not included in official annual tolls and as with war and terror casualties, persons whose traumatic injuries result in deaths attributed to subsequent complications.

The rise in death tolls will result from a policy of increasing dependence on motor fuels just when world recoverable energy reserves are expected to peak and oil prices stop falling - between 2007 and 2014 (MacKenzie, 1995). The risk assessments in this paper require us to exercise the responsibility not only to prevent this dependence, but to apply the dictum that “...(s)he who saves a human life it is as though they have saved the whole world” (The Talmud, Sanhedriah 96b).

The question to be asked is if not now, when?
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Transport and Health – a biomedical perspective

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Abstract
Global motorisation has become a major health problem. This is not only due to rapidly escalating road traffic accidents but also to the contribution of vehicle exhaust emissions to heart attacks, strokes and respiratory disease as well as the indirect effect of low quality living environments on levels of mental and physical fitness. Second only to tobacco smoking, motorisation has become the worlds most compelling health problem.

Keywords

Introduction
The links between transport and the illnesses experienced by individuals, the viability of communities and the health of the population have become increasingly evident as traffic levels in many western countries approach saturation. Local authorities, health professions and national governments are unable to avoid the conclusion that transport policies and practices have become a key determinant of the health of the population and a major economic burden. Furthermore, because these effects are amenable to manipulation by policy instruments, transport policy represents a compelling interface between short term political expediency and evidence based, longer term planning.

Before the second world war our cities were compact and designed largely for transport by foot, bicycle and horse. However, huge numbers of pedestrians, cyclists, drivers and passengers were being killed and maimed as cars drove around on unmarked, unregulated and unsegregated roads. No significant prospective thought as to how this situation could be intelligently managed was entertained, and as systems of mass production, given a kick start by the second world war, produced cars and lorries in their millions, the situation in our cities became critical.

Despite the fact that relatively few people owned cars at that time, or were expected to due to post war austerity, European cities were redesigned around the cars considerable appetite for space and energy, while US cities largely evolved to serve the motorist from scratch. While this was partly an attempt to reduce danger by restricting the free movement of those outside cars, it was also an attempt to act out a vision of the future where the needs of the car were assumed to be identical to human aspirations and what is loosely termed ‘progress’.

This experiment has been almost completed in the west where traffic growth has led to saturation of the abundant provision of roads. Congestion and its resultant inefficiency has led to increasingly eloquent calls to restrict traffic growth. From an ethical as well as from a functional standpoint, an analysis of the impact of the various emissions from vehicles as well as the changes in lifestyles, behaviour and the effect on society consequent on the development of a motorised society must become an essential component of future transport policy.

Air pollution
A few recent high quality studies provide compelling evidence on the impact of vehicle emissions on the populations health. Although the total impact goes further than these studies reveal, they are worth describing in a little detail.

Wiat et al. (1993) examined the links between respiratory symptoms, lung function and exposure to traffic in Munich. Although there could be no ‘control’ group (because all western children are exposed to some degree of air pollution) they were able to divide the population into ‘low’, ‘medium’ and ‘high’ exposure groups on the basis of the traffic
density near their schools. They found statistically significant increases in respiratory symptoms and decreases in lung function in children who were exposed to high levels of air pollution when compared to the other groups. Factors such as social class and exposure to tobacco smoke were accounted for in the study. Their conclusion was that exposure to vehicle emissions causes short term effects on the respiratory health of children. Importantly, none of the pollutants measured in Munich during the study exceeded recommended guidelines, so these impacts will be similar in many other western cities, and will be magnified in the heavily polluted cities of the developing world.

The Europe-wide APHEA Project examined levels of mortality and compared them to levels of measured pollutants affecting 23 million people in various European cities. Their key findings were that increases in SO\(_2\) (or black smoke) of 50 mg/m\(^2\) and in PM10s (or particulates) of 50 mg/m\(^2\) were associated with an increased daily mortality of 3% and 2% respectively. Their findings, like those in Munich, add to the mounting evidence that air pollution below the levels of national and international standards have serious adverse effects. A further cause for concern is that the effect of the pollutants they examined were additive, and could be to be added to further by the many pollutants not in the study. They conclude that current low levels of SO\(_2\) and particulates affect health and recommend that further reductions in air pollution from vehicle exhausts are needed.

Dockery et al. (1993) found a significant link between mortality and the level of fine particulates in six US cities and this has been confirmed in European studies. On the basis of their work particulate emissions alone have been estimated to be associated with 10,000 premature deaths a year in the UK. These deaths seem to be caused by contact of the particulates with the deepest lining of the lungs which leads to inflammation at the blood-air interface and an increase in the viscosity of the blood. This increased “stickiness” of the blood causes an increase in the rate of heart attacks and strokes, which being the main killers in the western world causes a significant increase in mortality. This has been confirmed by recent work in London which suggests that 6000 heart attacks a year in the UK are triggered by emissions from vehicle exhausts (Poloniecki et al. 1997).

Therefore, we can say that the evidence so far, underfunded, poorly co-ordinated and poorly supported as it has been, has shown that emissions from traffic increase the mortality rate of the population and causes significant respiratory symptoms in children. There is growing evidence to support these findings and no evidence which demonstrates the safety of emissions to the population.

Two further general points are worth considering. Firstly, while the acute effects of vehicle emissions are increasingly acknowledged, the longer term chronic effects, particularly on children who are growing up in motorised societies are completely unknown. It would be irresponsible to assume that the known acute impacts on health will not lead to chronic illness.

Secondly, the effects documented in European and US cities are magnified in cities from Santiago to Bangkok, where, following the example of the west, health costs are generally not a part of the decision making process.

So from the relatively localised ‘pea-soupers’ of post war coal burning cities we now have a global air quality problem with vehicle emissions affecting the lives of billions of people. The challenges, compared to the compact sulphurous smogs of the past are considerable but the financial and human costs of the health impacts of transport are now sufficient to change and direct previously ill informed transport policy.

**Danger**

Air pollution is not the only, or even the main health issue when it comes to traffic. Motorisation of society has had a defining effect on the physical and social structure of our cities and countryside, and thus the lives of those within them. Danger is the most pernicious of these effects. In the UK from 1982 to 1992 there were 51,115 deaths, 635,687 serious injuries and a total of more than three million casualties due to accidents. In one of the most comprehensive studies of the global burden of disease, Murray and Lopez (1997) have predicted that the numbers killed annually are set to rise from the current 999,000 to 2,400,000 millions a year by 2020.

Grim though these statistics are, the effects of road deaths go far beyond numbers can show. Sudden death is always difficult to cope with, and loss in a road traffic accident is particularly traumatic. Bereavement is complicated by various ‘if
only' scenarios together with a sense of betrayal, due to the lenient attitudes of the legal system to drivers who kill.

Bereaved families suffer various physical symptoms, psychological suffering, relationship problems, reduced ability to make plans for the future, less ability to enjoy life, and require more psychotropic medication to help them cope (Shanfield and Swain 1984). Parents of children who die in road traffic accidents grieve longer and with more intensity than those lost in other ways. It has been left to the families in the UK to form associations such as RoadPeace to research the issues, pursue justice and campaign for change.

Recent reductions in deaths due to road accidents in the UK should not be misunderstood as due to increased safety (reduced traffic volume and speed, careful driving, better traffic management, etc.) but rather more to reduction of risk. Evidence to the main cause for the reduction in accidents over the last twenty years, particularly to children, is in fact due to reduced exposure to traffic. Campaigns to educate children, in particular to respect roads, from 'Look Left Right and Left again' to the notorious 'One False Move' campaign (1989) by the UK Department of Transport which effectively threatened children with death if they behaved normally for their age, have focused on the behaviour of victims rather than the drivers. This has, however, always been harder to manipulate than the readily available and effective means of reducing danger by reductions in speed, illegal parking and traffic volumes, and provision of safe infrastructure for pedestrians or cyclists.

It must also be remembered that deaths are at the apex of the pyramid of damage due to road traffic accidents. Beneath them lies a huge burden of physical and psychological disability. From the enduring physical disability resulting from severe injury to the common 'whiplash' spinal injuries after minor accidents, the transport sector comprises a significant burden for health systems. In the developing world the health care systems required for motorisation have not been established in time to cope with the resultant health needs and many millions of victims are and will continue to receive inadequate care.

Noise

Unremitting noise from traffic has become a feature of modern life. Although traffic noise particularly impacts on the hard of hearing, who form a significant part of the population and children for whom sound is a crucial part of their learning experience, the effects are spread across the population.

It has been reported by the OECD that 14% of Europeans suffer from serious road noise. The effects include disturbed sleep, impaired mental functioning, poor concentration, increased blood pressure and psychological stress. Research from Spain has found that the performance of schoolchildren is adversely affected by traffic noise and this has unquantified implications for education as many schools have been built close to roads. Although classrooms can be insulated, they often are not, and outdoor play, which is crucial to a child's socialisation, is impaired when continually disturbed by noise.

Wider impacts of noise on people are also evident. Highly valued 'Peace and Quiet' has diminished considerably in recent years, and is likely to diminish further due to increases in traffic and increased provision of roads. The area of tranquillity available in the popular tourist destination of the Southwest of England has diminished by 20% in the last thirty years, and tranquil areas are now far more difficult to find (CPRE, 1996).

Community function

Functioning communities complement individual and family function. They allow adults to have a richer day to day life and children to develop healthy behaviour as a result of appropriate and spontaneous social interaction. For communities to work the links between families, friends and acquaintances should be nurtured by a structure which allows people to share resources and needs, and to interact spontaneously. The reduction in exposure to community life consequent on modern, dangerous, low amenity environments has many health implications.

Women, in particular, have to deal with a significantly increased burden when it comes to the everyday experience of parenting due to the effects of motorisation (Hillman, 1991).

While in 1971, nine out of every eleven British 7-8 year olds travelled to school on their own, by 1990 just one in eleven were allowed to do so by their parents. Although 80% of children own a bicycle and thus have the means to travel to school on their own, only 2% feel confident to do so (Hillman et al., 1990). This represents an uncompensated loss of independent mobility for children and an increase in parental workload due to
danger from traffic.

Opportunities for unsupervised outdoor play which benefits both children and parents has been dramatically reduced, with most play now taking place indoors or in supervised nurseries or playgrounds. Unsupervised play is important in allowing children to adjust to their own peer group without interference, and also in allowing parents breaks from otherwise unremitting child care. In urban areas 10% of people in the suburbs, and up to 40% in the inner cities move home each year. Urban house owners sell their properties on average each seven years. Such a flux of population destablises communities as people are continually on the move, often in an attempt to move to better surroundings, which, in the urban setting means away from busy roads, traffic, danger, noise and pollution. Informal links which create community and the support for individuals and families they can provide are lost, placing strain on the family and consequently health and social services.

We would argue that the burden of work in the informal sector has shifted from community to family structures, and this usually results in extra work for women. This increased workload, and the sense of isolation from traditional sources of support is partly to blame for increasing rates of depression and anxiety amongst mothers. Furthermore, the lack of high interest environments and functioning communities, which can meet needs from support to adventure also has its part to play in the increasing rates of psychiatric problems and suicide amongst children and adolescents.

Traffic has also been shown to inhibit social interaction more generally (Appleyard and Lintell, 1972). This is supported by conversations with the elderly or through the plethora of urban or rural ‘yesteryear photo books’ which reveal the same disturbing phenomenon. There simply used to be more people out and about, meeting each other and engaging in what, for a social animal, is vital - the opportunity for spontaneous and unpredictable social interaction. In many communities, such opportunities have simply been engineered out of society due the needs of the transport sector, and are being reintroduced at what could be best described as a snail’s pace.

**Lifestyle**

Anthropologists have pointed out that during the evolution of our species we have adapted to a remarkably constant environment (Boyden 1987), and it is by that environment human anatomy and physiology have been moulded. Transport has always been a fundamental human activity which, until recently, was associated with the expenditure of significant amounts of physical energy. However, with motorisation we have created a different physical environment and thus lifestyle, of which the effects on human health require recognition.

The lack of potential for exercise now built into the lives of the population has a large part to play in the recent decline in the quality of health of the population. Parents who take little exercise also pass this habit onto their children, but most adults too, perform trips without the expenditure of any significant energy (Moore et al., 1991).

The lack of fitness of young people is of particular concern. A recent study performed at Exeter demonstrated that many children were missing out on levels of exercise vital for appropriate physical development: 36% of boys and 51% of girls had no periods of exercise lasting 10 minutes during school or at home (Armstrong et al., 1990). The conclusion is that most children are not getting enough exercise to avoid adverse health impacts later in life.

Adults fare little better. A survey by the Health Education Council in 1991 has found that 81% of middle aged men failed to reach the targets for healthy levels of exercise, and 40% of those in the 65-74 age group took no vigorous or moderate exercise. Across all age groups women were even less active than men. Even walking up a slight incline at normal pace for more than a few minutes was too much for nearly one third of men and two thirds of women and half of middle aged women are not even fit enough to walk at a pace of 3 mph on the flat.

Regular aerobic exercise is particularly effective in the prevention of coronary heart disease, osteoporosis, obesity and diabetes. According to the Royal College of Physicians (1991), any potential hazards of exercise are substantially outweighed by the benefits. In the past reasonable levels of exercise could be gained as a part of the day to day requirements for getting around, namely by walking and cycling.

However, despite Government health targets in the Health of the Nation strategy, rates of obesity, a good marker of the amount of exercise taken by a population, have increased from 7% to 12% in men, and from 13% to 16% in women from 1986-94. Osteoporosis, diabetes, and other illnesses associated with lack of exercise are also on
the increase and are becoming considerable economic burdens as well as a major problem for those afflicted by them.

It is becoming clear that across all ages and social groups, insufficient exercise is being taken to avoid illness in the future. The longitudinal effect of unprecedented inactivity on the growing generations is completely unknown but clearly a cause for concern. If we look at what constitutes health promoting exercise we can find good evidence that physical forms of transport offer real benefits in terms of reduction of illness and promotion of health as well as reductions in the impact of motorisation and traffic.

If health consideration such as these were considered by transport planners then safe routes to schools, communting plans to work and an attractive urban environment would have much to commend them.

Social inequalities
Transport has become a major contributor to social inequalities which are themselves an important and increasing contributor to ill health. At the most basic level the mechanics of our transport system offer relative disadvantage to many groups of the population with low rates of car ownership. These include many people with long term illnesses, those of pensionable age, unemployed people, people classified as economically inactive, and those aged under 18 years.

An analysis of socio-economic influences on childhood deaths in the last census showed that children of single parents are four times more likely to be killed in a road traffic accident than other children. This group of people highlights the differential impact of transport on society. Single parents are a particularly disadvantaged sector of society who have the greatest problems with access and often live in the poorest, most heavily trafficked, and most dangerous areas. Such accidents are often predictable, related to poor design of housing, roads and vehicles together with a lack of appreciation of childrens perceptual abilities on the part of transport planners and ‘experts’ in child safety. Accidents caused in this way have become a major contributor to health inequalities first identified in the Black report in the late 1970s, and confirmed as worsening in the 1990s.

Other effects of traffic also impact differentially on the less well off. Noise, air pollution, danger and low interest environments are all to be found nearer busy roads and in areas subjected to heavy traffic. Further, cars do not come cheap, and the burden of requiring a car to maintain access means reduced spending on other items. The lower the disposable household income, the more of a problem this becomes. The trickle away effect of wealth to the suburbs and beyond leaves lower quality city centres with multiple ring roads and radial routes built to maintain access from the periphery. The associated car parks and congestion are the physical manifestation of this growing inequality in our society.

Global effects
A possibly greater threat to human health from transport relates to its massive consumption of fossil fuels, and the consequent generation of greenhouse gases and other waste products. Climate change is resulting in relatively sudden changes in disease patterns, reduced capability for food production and potential flooding in low lying countries. At the root of climate change are the emissions of 8 billion tonnes of Carbon dioxide from fossil fuels which were removed from the atmosphere earlier in the life of the planet by massive forestation, enabling animal life to evolve. The Carbon dioxide sequestered during this long term process is now being rapidly released back into the atmosphere.

One way of looking at this is to examine the amount of oxygen consumed by cars during combustion and ask how many trees would be required to supply this demand. Relatively simple calculations (based on data in Williams, 1973) reveal that in the UK alone we would need 35,200,000,000 trees producing oxygen simply to keep our cars running. Furthermore, this only applies to the running of cars and does not include the energy required for the vehicle construction, decommissioning and the building and maintenance of infrastructure. When the cradle to grave costs of transport are taken into account it is by far the most energy hungry and polluting of all humankind’s activities. The consumption of oxygen demonstrates how, with a car based transport system it is impossible to replace the resources we remove from our planet, and as such the system is, by definition, unsustainable, and will have to change.
Conclusion

Transport has become a major global health problem. Many of the illnesses which take life from years and years from life continue to have causes rooted in the structure of society rather than the decision making processes of the individual. Unsustainable and socially unjust planning have created transport systems which dominate living environments and differentially burden the socially and economically disadvantaged throughout the world with unhealthy environments in terms of pollution, noise and danger, as well as psychological and physical stress. The resulting health problems are now manifest in the west and are set to cause unmanageable health problems in the developing world where health care systems required to mitigate the effects of motorisation, even in terms of management of road traffic accidents, are unavailable and unaffordable.

The argument that the economic activity associated with motorisation fully mitigates against these health impacts is unethical. The millions who will die annually, the tens of millions who become disabled, the hundreds of millions affected by air pollution, noise, danger and community decay demands an urgency that administrations so far seem to have been keen to ignore. While better transport planning may be evident in the west this seems more due to the impracticalities and inefficiencies of congestion rather than reality behind health statistics. The developing world must avoid compacting into a single decade the mistakes we have made in the west over the last fifty years, and for this to happen co-operation in terms of development will have to be another new era. It must, to a far greater degree, be led from the bottom by existing communities, rather than dictated from the top by national governments and multinational companies. A reasonable start would be for the British Government to take more notice of the recommendations of its own Royal Commission on Environmental Pollution which provides hundreds of policy suggestions which make sense in terms of health and transport.

If any Government or community facing the challenge of transport needs ammunition to help them design a better, and that means healthier society over the next few decades, they need look no further than mounting health evidence to provide the force for change, the building blocks for better transport systems, a healthier society and we believe, a sustainable future.

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Children’s journeys to school - new data and further comments

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Abstract
This paper addresses a debate about children’s journeys to school previously published in this journal in 1995. The parents of 315 children aged 7-11 in Oxfordshire were surveyed about their children’s travel freedoms. The data are discussed in the context of current debates about transport, attitudes and lifestyle.

Key words
UK/Oxfordshire, Children, Local journeys, Cycling

Background
The topic of children’s journeys to school remains of interest to transport specialists and environmentalists as the use of the car on this journey adds substantially to congestion on the roads. It accounts for 20% of car driver journeys between 8.30 and 9.00 a.m. and shows no signs of diminishing (Department of Transport, 1995). In Hillman, Adams and Whitelegg’s (1990) One False Move, 64% of junior children were accompanied on the way to school and of those, 52% travelled by car (see Table 4, p. 133). In our 1993 study 68% of 7-11 year olds were accompanied by an adult, and of those, 56% were taken by car (Joshi and MacLean, 1995). In investigating parental attitudes it is clear that a number of factors are involved: these include fear of traffic danger and stranger danger (Hillman et al., 1990; Lee and Rowe, 1994; Bradshaw, 1995; Joshi and MacLean, 1995; Valentine, 1997a, 1997b). In our analysis of parental reasoning, we placed a greater emphasis on stranger danger than did Hillman et al. (1990), and attributed this in large part to our methodology which permitted parents to indicate multiple reasons for accompaniment.

This paper again focuses on the journey to school. In the context of a broader study of the effects of accompaniment upon children’s development (Joshi, MacLean and Carter, 1997), further journey and attitude data were obtained from an additional sample in late 1995. We would like to present this more recent data and also use it to address Hillman’s (1995) criticisms of our earlier work.

Data
Sample characteristics
Hillman (1995) suggests that our 1993 sample may not have been ‘representative’ as most of the parents were interviewed in shopping areas whereas his were drawn from state school samples. In defence of our original sample, it can be stated that while not all children attend state schools, most parents do go shopping [Nationally, approximately 94% of children attend state schools; however in Oxfordshire the figure is 88-89% (Systems and Research Unit, Education Department, Oxfordshire County Council)]. However, like Hillman, our 1995 sample was a school one and comprised the parents of 315 children, aged 7-11 years, in two primary state schools in Oxfordshire. The schools were located in established estates in the towns of Bicester and Witney: each being some 15 miles from Oxford, beyond its green belt. Fifty-nine percent of the children were accompanied by an adult on the journey to school and, of those children, 32% travelled to school by car (see Table 1). Among the parents of accompanied children, 84% cited stranger danger and 50% cited traffic danger as a reason for accompaniment. These data thus confirm our earlier observation that stranger danger is the most frequently given reason for accompanying children to school is this age group. Furthermore, when asked to nominate their most important reason 48% cited stranger danger and only 15% cited traffic danger.

Distance and the school journey
Hillman rightly notes that when comparing data sets care must be taken over the

[17]
comparability of the actual journey distances involved. In One False Move, 81% of English junior school children lived within one kilometre of school and, of the entire junior sample, 33% were driven to school by car (see Table 7, p. 135). In our new data set a similarly high percentage (92%) lived within one kilometre of school, and 19% were driven to school. The relationship between distance from school and mode of travel is a complex one. Long distances are unlikely to be walked (alone or accompanied), but cars can be used for very short distances. There is in our recent data, a statistically significant relationship between distance and use of the car (amongst those who own a car) but the correlation is not very high - i.e. distance accounts for only 18% of the variance in car use ($r = 0.42$, $p < 0.001$, $n = 286$). If we examine the journeys of only those who lived within 1 kilometre of school, distance is even less important - accounting for only 7% of the variance in car use ($r = 0.26$, $p < 0.001$, $n = 261$). Across the entire sample 91% of families owned one or more cars but only 21% of them used a car to take their children to school. Two-car families (who constituted 39% of the car owners) were more likely to use a car than one-car families ($c^2 = 23.07$, df = 1, $p < 0.001$) but even amongst two-car families only 35% used a car for the school journey. The unimportance of distance as a determining variable is also revealed by examining details of the travel patterns of those children who did not travel to school by car. Among those who walked to school (i.e. 76% of our sample), accompaniment was not related to distance - those who travelled with an adult walked on average 0.51 kilometres (with a range of 0.21 - 0.91 km), and those who travelled alone or with other children walked on average the similar distance of 0.48 kilometres (with a range of 0.14 - 1.31 km). We interpret our data as suggesting that accompaniment is related primarily to parental attitude rather than to distance, and that mode of accompaniment, of course, is related to distance and car availability but also to other factors (such as parental journey to work, the transportation of other children to different destinations, etc.)

### Reasons for accompaniment

Certain reasons for accompaniment varied with the age of child (see Table 2). Stranger danger was mentioned by 84% of all parents who accompanied their children to school; however, it dropped from above 85% in the case of 7-8 year olds to 67% in the case of 10-11 year olds. Citations did not differ according to the gender of the child. This was also the case in our previous data set and had caused surprise to Hillman in his rejoinder. It is apparent from his comments that Hillman supposes stranger danger to be associated in parents’ minds with the fear of sexual molestation of older girls. We assume that his surmise derives from his data which suggested gender differences in parents’ concerns when restricting the leisure activities and after-dark journeys of their children of senior school age. In contrast, our survey focused on children of junior age and only on reasons for accompaniment on the school journey. Neither we nor Hillman have interviewed parents about what they mean by stranger danger. However, our new sample confirms our earlier finding; the citation of stranger danger is inversely related to age of child, and at this age of child, is not related to child gender. This is not surprising. Girls are disproportionately represented in cases of sexual abuse (Creighton, 1992; Gillham, 1996), but the perpetrator in the majority of such cases is known to the victim and we suggest that this is not the threat which parents envisage on the school journey. [Reviewing studies which have investigated the prevalence of sexual abuse, Gillham (1996) comments that “What all the studies do is challenge the very general assumption that it is the development of secondary sexual characteristics which renders girls particularly vulnerable to abuse. Clearly pre-pubertal girls are most at risk” (p. 121)]. Rather, they fear the rare case of abduction by a complete stranger and recognise that young children are at as much risk as older children, and boys at as much risk as girls (Home Office, 1995, 1997). Thus we interpret our data as suggesting - entirely uncontroversially in our view - that parental fear of stranger danger focuses on their younger not older children and on both boys and girls, as they doubt their younger children’s ability to recognise such danger or indeed “escape” from it.

Hillman (1995) criticises the “Run, Yell, Tell” campaigns of organisations such as Kidscape for inculcating an exaggerated fear of strangers in children. If this was the case

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**Table 1: The journey to school: children aged 7-11**

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<td>(N=315)</td>
<td>Walk</td>
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<tr>
<td>Alone</td>
<td>12 %</td>
<td>95 %</td>
</tr>
<tr>
<td>With another child</td>
<td>29 %</td>
<td>97 %</td>
</tr>
<tr>
<td>With an adult</td>
<td>59 %</td>
<td>66 %</td>
</tr>
<tr>
<td>Overall % by mode</td>
<td>100%</td>
<td>78 %</td>
</tr>
</tbody>
</table>
we would expect to find evidence of fear-driven imagery apparent in children’s perceptions of the environment. However, our own research (Joshi, MacLean and Carter, 1997) suggests very clearly that stranger danger is not dominant in the majority of children’s perceptions of their environment. We did not directly investigate children’s knowledge of road or stranger danger safety codes, but it is certainly possible that children acquire such knowledge without it overwhelming their everyday thinking about the environment. The question of whether children can implement safety knowledge in appropriate situations is a complex subject and beyond the scope of this paper. Such issues have been researched in the road safety domain (Thomson, 1996). In his rejoinder, Hillman (1995) also rightly reminds us of the role of the media in influencing both children’s and adults’ perceptions of risk. However, it is empirically very difficult to establish the role of the media in these matters as research on children, television and violence has shown (Gunter and McAleer, 1990).

The fear of traffic danger showed a very strong relationship with age, dropping from 71% amongst the parents of 7 year olds to 17% in the case of the parents of 10-11 year olds (see Table 2). Three other reasons for accompanying were also more likely to be cited by the parents of younger children: having contact with other parents, child hanging about on the way to school and accompanied being “the done thing”. The only reason for accommodation which showed age effects in the opposite direction was “adult travelling to work that way anyway”. This was cited by only 9% of parents of 7 year olds but by 39% of the parents of 9-11 year olds. This pattern fits with national data sets which show that the likelihood of a mother being in paid employment rises incrementally with the age of her youngest child (Joshi, 1990). Indeed, in our own data set, amongst two-parent families there was a positive relationship between age of youngest child and the likelihood of both parents being in paid employment.

Even stronger age effects were shown in a further data set - i.e. a survey of the parents of 457 children aged 5-16 years in six different locations (three on the edge of Oxford City, and three in Oxfordshire). This data set formed part of a larger survey of residence and car-based travel (Curtis and Headicar, 1994). Amongst 5-6 year olds, all but one were accompanied by an adult on the journey to school and, of those, 54% were driven by car. Amongst the 7-9 year olds, 89% were accompanied by an adult and, of those, 48% were driven by car. As in our previous study (Joshi and MacLean, 1995), and parents of young children cite ‘positive’ as well as ‘negative’ reasons for accompanying their child - such as having contact with their child’s teachers and with other parents, and simply enjoying taking their child to school (see Table 3). Amongst 10-11 year olds, 51% were accompanied by an adult and, of those, 67% were driven by car. Amongst the oldest age group (12-16 year olds), only 28% were accompanied by an adult, but of those children 95% were driven by car. Thus the propensity to accompany diminishes with the age of child, but that if accompanying, the propensity to accompany by car increases with the age of the child. As already indicated in the above paragraph, composite journeys play a significant role in the case of older children. In this larger data set 47% of the parents of accompanied 10-11 year old children are simultaneously accompanying a younger child and 37% of the parents of accompanied 12-16 year olds are journeying to work. A further reason for ‘prolonged’ accommodation emerges strikingly at the 12-16 year old age bracket - i.e. parental perception of public transport as inadequate. It is worth noting that 62% of parents of accompanied 12-16 year olds said they would prefer their child to travel to school without an adult, ideally by bus. Some parents would like to see improved public transport (often specifying that the service should be direct); others wished to see a school bus service.

### Table 2: Reasons for accompaniment to school which varied by age of child

<table>
<thead>
<tr>
<th>Reason cited by parents who accompany</th>
<th>All</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N=186)</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Stranger danger</td>
<td>84</td>
<td>86</td>
<td>91</td>
<td>82</td>
<td>57</td>
</tr>
<tr>
<td>Traffic danger</td>
<td>50</td>
<td>71</td>
<td>49</td>
<td>44</td>
<td>17</td>
</tr>
<tr>
<td>Contact w. other parents</td>
<td>49</td>
<td>58</td>
<td>54</td>
<td>44</td>
<td>25</td>
</tr>
<tr>
<td>Child might hang about</td>
<td>19</td>
<td>36</td>
<td>16</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Done thing</td>
<td>19</td>
<td>31</td>
<td>14</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Journey to work</td>
<td>26</td>
<td>9</td>
<td>25</td>
<td>40</td>
<td>38</td>
</tr>
</tbody>
</table>

### Other travel freedoms

Hillman et al. (1990) also examined children independent mobility in a variety of other domains and noted, for example, that only 37% of junior school children were allowed to “go places other than school” on their own. Following their lead, in our Bicester and Witney survey we also investigated a
variety of children’s travel licences. In asking parents about the licences they grant their children, we allowed them to distinguish between permitting a child to engage in an activity with other children or on their own. All four licences showed statistically significant variation by age (see Table 4), but not by gender. The vast majority of children played in the street but only in the company of other children. At 7 years of age, only 30% of children went to local shops (within 2 mile), and generally only with other children. At 8 and 9 years, the majority were allowed this freedom, and by 10 years, 59% made this kind of trip on their own. At 7 years, 32% of children went to the park with other children. At 8 and beyond, the percentage rose and was most substantial (78%) by the age of 10. However, almost no children were allowed the freedom to go to the park by themselves. Very few children went to more distant shops by themselves, and it was only at aged 10 and above that even 16% were allowed to do so with other children.

One can look at Table 4 and paint a picture of contemporary children leading rather restricted lives, if doing things alone is the key indicator of freedom. However, at 8 years and beyond, the majority of children in our sample were permitted the freedom of the street and the park - although only in the company of other children. This is still freedom. For many authors, the reliance on the car in contemporary society is thought to be a key factor in limiting children’s non-school travel freedoms. If this were the case then one might expect the children in families without cars to have more freedom than children in families with cars. This was not the case. Parents without cars were no less likely to accompany their children on the school journey than were parents with cars, nor did they differ in the amount of other freedoms which they granted their children.

Much has been written on the decline of the bicycle as a mode of transport - both amongst adults and children (BMA, 1992; Devos, 1992; Royal Commission on Environmental Pollution, 1994). While it is the case that only 2% of the children in our sample cycled to school (see Table 2), 98% of children in the sample owned a bicycle and we investigated their use. Table 5 shows that 85% cycled in their own street and 51% cycled within half a mile of home. Cycling in local parks or playgrounds was permitted to over 50% of 9-11 year olds. Few children cycled beyond half a mile from home either on or off road. As in walking to the shops (Table 4), the only group with any indication of freedom in terrain more than half a mile from home were 10-11 year olds, and those generally only in the company of other children.

In order to compare freedom in the two modes of transport the separate measures were summated and then averaged to give composite walking and bicycle freedom scores. Statistical analysis indicates that walking freedoms varied by age (F = 28.73, df 3/301, p <0.01); and cycling freedoms varied by age (F = 7.96, df 3/294, p <0.001), gender (F = 6.90, df 1/294, p <0.01), and by age x gender (F = 2.75, df 3/294, p <0.05). Figure 1 shows that walking freedoms are granted to the majority of 8, 9 and 10-11 year old children. Although cycling freedoms increase with age, it is only 10-11 year old boys who are granted any substantial degree of freedom. As we have discussed elsewhere, further research is needed to establish

Table 3: Reasons for accompaniment to school which varied by age of child
(additional data set - 6 locations)

<table>
<thead>
<tr>
<th>Reason</th>
<th>Cited by parents who accompany:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All 5-6 7-9 10-11 12-16</td>
</tr>
<tr>
<td>N=298</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Stranger danger</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Parent enjoys taking</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Contact w. teachers</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Traffic danger*</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Contact w. other parents</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Taking younger child</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Child wants to go w. adult</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Journey to work</td>
<td>% % % % %</td>
</tr>
<tr>
<td>No direct public transport</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Child might lose way</td>
<td>% % % % %</td>
</tr>
<tr>
<td>Child might hang about</td>
<td>% % % % %</td>
</tr>
<tr>
<td>School insists/preferences</td>
<td>% % % % %</td>
</tr>
</tbody>
</table>

* In the data set above, the wording “Child not yet able to cross roads” had been used in the parental questionnaire, in the data set referred to in Table 2, this item had been labelled as “Traffic danger/Child not yet able to cross roads”.

Figure 1: Mean walking and cycling freedom

[20]
whether this gender difference represents a difference in freedom granted or a difference in the use of that freedom (Joshi et al., 1997). Girls aged 10-11 may be permitted such freedoms but, through lack of interest, simply not take them up.

We also investigated one other aspect of freedom - that is the extent to which children were permitted to be "out and about nowhere in particular". These questions focused on the time that a child was allowed to be out alone. Across the sample 65% of children were permitted out alone but only with a fixed time for return; a further 2% were allowed out with no fixed time for return. 37% were only allowed out if their parents knew exactly where they were going and 30% could be out without their parents knowing exactly where they were, but usually for only half an hour or less. Only 8% of the children could be out for an hour or more without their parents knowing exactly where they were. Sixty-seven percent of these children were boys, and 48% were aged 10 or above. However the trend for this kind of freedom to be granted more often to older children and/or to boys did not reach statistical significance.

Parents' own journey to school

The parents who had completed our questionnaires (92% of whom were female, mean age 36 years, range 24-58 years) also answered questions about their own mode of transport to school. On average they themselves had started travelling to school without an adult at 8.2 years, 87% of them in the company of other children. When first travelling to school without an adult, 75% had walked, 5% bicycled and 20% had gone by bus. Those who had bicycled had started travelling without an adult at an older age (on average 9.7) than those who had walked or gone by bus. In order to investigate the relationship of parental variables to current practice two logistic regressions were conducted. Children were more likely to be

Table 5: Children's use of their bicycles by age (%)

<table>
<thead>
<tr>
<th>Age</th>
<th>Alone</th>
<th>Only with other kids</th>
<th>Only with an adult</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>In own street</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>16</td>
<td>60</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>26</td>
<td>62</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>25</td>
<td>59</td>
<td>11</td>
</tr>
<tr>
<td>10-11</td>
<td>10-11</td>
<td>39</td>
<td>52</td>
<td>5</td>
</tr>
<tr>
<td>(N=308)</td>
<td>All</td>
<td>27</td>
<td>58</td>
<td>10</td>
</tr>
<tr>
<td>Locally within 1/4 mile of home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>3</td>
<td>21</td>
<td>58</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>7</td>
<td>35</td>
<td>37</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>16</td>
<td>42</td>
<td>29</td>
</tr>
<tr>
<td>10-11</td>
<td>10-11</td>
<td>22</td>
<td>50</td>
<td>17</td>
</tr>
<tr>
<td>(N=308)</td>
<td>All</td>
<td>13</td>
<td>38</td>
<td>34</td>
</tr>
<tr>
<td>In local park or playground</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>1</td>
<td>24</td>
<td>54</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>1</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>1</td>
<td>53</td>
<td>34</td>
</tr>
<tr>
<td>10-11</td>
<td>10-11</td>
<td>4</td>
<td>64</td>
<td>16</td>
</tr>
<tr>
<td>(N=307)</td>
<td>All</td>
<td>2</td>
<td>45</td>
<td>36</td>
</tr>
<tr>
<td>Beyond 1/4 mile from home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>73</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0</td>
<td>5</td>
<td>59</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>0</td>
<td>5</td>
<td>65</td>
</tr>
<tr>
<td>10-11</td>
<td>10-11</td>
<td>5</td>
<td>14</td>
<td>42</td>
</tr>
<tr>
<td>(N=308)</td>
<td>All</td>
<td>1</td>
<td>7</td>
<td>59</td>
</tr>
<tr>
<td>In parks or playground &gt; 0.5 mile from home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>57</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>0</td>
<td>7</td>
<td>57</td>
</tr>
<tr>
<td>10-11</td>
<td>10-11</td>
<td>1</td>
<td>16</td>
<td>38</td>
</tr>
<tr>
<td>(N=306)</td>
<td>All</td>
<td>0</td>
<td>6</td>
<td>54</td>
</tr>
</tbody>
</table>

Table 4: Children's travel freedoms by age of child

<table>
<thead>
<tr>
<th>Age</th>
<th>% Alone</th>
<th>% Only with other children</th>
<th>% Only with an adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plays in the street</td>
<td>7</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>3</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>11</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>10-11</td>
<td>13</td>
<td>87</td>
</tr>
<tr>
<td>N=289*</td>
<td>All</td>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>Goes to local shops within 0.5 mile of home</td>
<td>7</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>19</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>35</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>10-11</td>
<td>59</td>
<td>29</td>
</tr>
<tr>
<td>N=317</td>
<td>All</td>
<td>31</td>
<td>30</td>
</tr>
<tr>
<td>Goes to local park/playground</td>
<td>7</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>1</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>2</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>10-11</td>
<td>1</td>
<td>78</td>
</tr>
<tr>
<td>N=319</td>
<td>All</td>
<td>2</td>
<td>55</td>
</tr>
<tr>
<td>Goes to shops beyond 0.5 mile from home</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>10-11</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>N=316</td>
<td>All</td>
<td>1</td>
<td>7</td>
</tr>
</tbody>
</table>

*30 children excluded from this table as their parents stated they never played in the street alone or accompanied.
accompanied if they were younger, had less general freedom as measured by the items in Table 4, and whose parents had themselves first gone to school alone at a later age (Likelihood Ratio \( c^2 = 85.00, df = 3, p < 0.001 \)). Accompaniment was not predicted by the sex of the child, parental age, car ownership or income. Amongst those families who owned a car, children were more likely to be driven to school if they had less general freedom, more than one car in the household and a higher household income (Likelihood Ratio \( c^2 = 36.50, df = 3, p < 0.001 \)). Being driven to school was not predicted by the age or sex of the child, age of parent or the age at which parent first went to school without an adult. These regressions reinforce the point made in an earlier paragraph that accompaniment relates to parental attitude but that accompaniment by car relates to parental resources and commitments.

**Conclusion**

It is well-established that the perception of risk is not always closely related to the 'reality' of risk (Slovic, Fischhoff and Lichtenstein, 1987). In our view it is likely that parents recognise that the absolute risk of their child being abducted by a stranger is very low but that their responses indicate that they nevertheless wish to avoid that risk.

The point thus remains that if stranger danger is an issue in encouraging parents in what transport experts regard as the 'unnecessary' use of their cars, then such fears must be addressed with as much vigour as traffic danger. Better public transport and/or school buses were seen by many parents as the ideal mode of transport to school, and for many had been their own initial mode of independent travel to school.

Further, as we stated in our previous paper, those who wish to persuade others to forgo their cars must not ignore the positive reasons parents have for accompaniment. Interestingly, if parking near school is scarce, some of these reasons (such as meeting teachers and other parents) can be met just as well - if not better - on foot. Walking to school with a young child would have the additional advantage of contributing towards saving the environment - although only if there is a widespread modal shift as it is otherwise subject to the "sucker" problem (see Hallsworth, Black and Tolley, 1995). Walking would also give parents and children regular exercise. Furthermore, it would allow children - a little earlier than otherwise - to develop their skills in the art of going to school without a car. Whether parents who are making composite journeys or have already adjusted to delays and congestion will be receptive to exhortations to change their behaviour remains to be seen.

**References**

Valentine, G., (1997b) "Oh yes I can! Oh no you can't! Children's and parents' understandings of kids' competence to negotiate public space safely. *Antipode* 29(1), 65-89.
Investment in Transport Infrastructure: Have the EU initiatives promoted their balanced and rational distribution?

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Abstract
The achievement of sustainable mobility and the completion of a unified trans-European transport network are two main targets of the European Union’s (EU) Common Transport Policy. The selective modal distribution of investment in transport infrastructure is among the factors that can facilitate their fulfilment. Specifically, the fast modernisation of the currently underdeveloped and environment-friendly rail and maritime transport modes is essential. However, the substantial financial involvement of the EU has not promoted the balanced and rational distribution of investment in transport infrastructure within Europe. This is particularly evident in the case of Greece, where under investment and mono-modal priorities had characterised the national level policies. The emerging EU financial contribution has not managed to alter this unsustainable policy.

Keywords
EU transport policy, infrastructure investments, Europe, Greece.

Introduction
The European Union’s plan to establish a unified trans-European transport network (TEN) is an attempt to integrate all national transport systems. Through the rational and balanced development of the different modes, these systems should become gradually integrated in operational terms in a wider context (i.e. the EU), and beyond that, the continent of Europe. This ambitious project demands the mobilisation of substantial capital for long-term investment. A critical problem is how the introduction of costly state-of-the-art infrastructure should be financed. Of similar importance are the qualitative assessment and the setting of priorities for the improvement of the infrastructure for the various modes. On the one hand, the objective is to accommodate the accelerated expansion of transport demand. On the other hand, transport is increasingly qualified as an activity with a negative environmental impact. Modal priorities have certain environmental consequences and, hence, evolve to influence the hierarchy of investment decisions. One should adopt a policy that sets more concrete objectives than just caters efficiently for demand. Initiatives that strengthen environment-friendly rail and water transport modes restrain the negative side effects of road transport. Hence, these are essential elements of a contemporary transport policy.

Whether the transport sector will serve Europe’s living standards in the best possible way depends mainly on demand management, that is, the reform of production and consumption prototypes, the adjustment of private behaviour, the reorganisation of the public sector, and the promotion of appropriate technologies. Still, such major changes have to be supplemented by effective choices in the supply side, in particular the selective modal distribution of investment in transport infrastructure. The latter can create considerable benefits and induce modal choices. User time savings is the principal perceived benefit component of road, railway, and airport investments. For seaport investments, cost savings (i.e. reduction of time spent in ports, economies of scale by using larger vessels, or vessels with special requirements or new technology which could not be accommodated before), are the most important benefits. The widely made (in practice) assumption that all modal growth is exogenous is a simplifying one, and may have caused appreciable planning or policy mistakes (Jansson, 1993). Rational planning and allocation of the available funds are indispensable elements of a successful transport policy.

On that account, this paper examines the EU financial contribution to investment in transport infrastructure (ITI). Specifically, it
focuses on their modal split, analyses the capital mobilisation that they have provoked, and concludes on how the different elements of the transport network are confronted within the concept of the trans-European network. The case study is that of Greece, a peripheral EU member state with geographica characteristics that facilitate the development of all the different transport modes. The data analysed in the empirical part are the investment payments that have been recorded by the Ministry of Transport and the Ministry of Environment, Fiscal Planning, and Public Works, the national administrations responsible for the development of transport infrastructure in Greece. The paper examines the investment policies that have been employed since the country’s accession to the EU in 1981 and argues that, at least at the moment, distribution of the limited EU resources has failed to promote the balanced and rational modal development of ITI. This contradicts the necessities for modal integration and inter-operability and undermines the concept of sustainable mobility.

**The Trans-European Transport Network Concept: What role for ITI?**

The Maastricht Treaty of the EU advances the development of a common transport policy incorporating economic, social, and environmental dimensions. This context upgrades the significance of the TENs for the progress of integration. The impetus is that a piecemeal development of the transport sector causes isolation of parts of the EU territory, hampers the competitiveness of the European economy, has negative effects on the environment, and increases energy consumption (CEC, 1994). Collective emphasis needs to be given to the economic and qualitative performance of the whole network and the protection of the environment (CEC, 1992a).

This strategy implicates the interconnection of the transport modes through the completion of the missing links, and the inter-operability of the existing links through their technical harmonisation. Its success demands the rational development of all the different modes, so that the sector will “meet the present needs without compromising the ability of the future generations to meet their own needs” (World Commission on Environment and Development, 1987). It insists upon the expansion of those modes whose operation produces the lowest demands in energy and the least possible negative effects to the environment, albeit without disregarding any other advantages resulting from the use of the different modes for passenger and freight transportation.

In fact, not all transport modes develop the same environmental effects. Transport may be the principal source of increasing emissions, an origin of both traditional pollution and the greenhouse effect, but the energy consumption for the tonne-kilometres moved presents impressive modal variations (see Table 1).

<table>
<thead>
<tr>
<th>Mode</th>
<th>Energy consumed</th>
<th>Freight lifted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>78.0</td>
<td>16.0</td>
</tr>
<tr>
<td>Marine</td>
<td>6.5</td>
<td>66.7</td>
</tr>
<tr>
<td>Air</td>
<td>11.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Rail</td>
<td>3.9</td>
<td>17.0</td>
</tr>
</tbody>
</table>

(source: Salyantin, 1993).

This imbalance is remarkable when the focal point, the total of the external costs, is considered. Significantly, neither the road nor the aviation industry covers the external costs that they produce. Internalising these external costs, is a complicated issue and depends on numerous parameters. Despite its potential contribution towards sustainable mobility, the possibilities of a practical policy solving the problem in the near future are limited (Rothengatter, 1993). This cannot be undermined, especially as the external costs associated with only road transport and excluding congestion are equivalent to around 2% in the six largest countries of the EU (Group Transport 2000 Plus, 1996; DRI, 1994).

The alteration of the current unsustainable reality rests on the rethinking of every public and private decision involving expenditure as a choice between a clean, energy efficient and low polluting option and a dirty, damaging one. This is particularly relevant for freight where time plays a less important factor than in the case of passenger transportation and where a shift to marine and rail transport is both possible and essential - a point valid in the case of inland waterways as well. Despite the notified public budget restraints, the distribution of public finance can be critical. Substantial ITI have the potential to reduce the costs of using particular transport modes and increase their potential to gain shares in the modal pie at the expense of those means which are problematic, either due to
satisfaction or other environmental effects. Rationality demands an investment strategy which will stimulate a modal shift. A sensible balance between the various transport modes cannot be struck when the transport modes incurring high social and environmental costs are given preferential treatment to those incurring much lower external costs, or when investments in all modes are not evaluated according to common criteria.

The conclusions of the 1994 All-European Transport Conference with the participation of transport ministries from 40 countries sustain that because Europe has entered a period when the control of transport emissions has become a major policy goal, and railroads and waterways should progressively attract more business at the expense of congested, less environment-friendly road transport. The decentralisation and the reorganisation of economic activities along with the modernisation and expansion of present networks continue to be among the essential conditions but are not enough by themselves.

The importance of ITI distribution is reinforced by the completion of the Single European Market. The Single European Market and the opening up of the markets in Central and Eastern Europe are expected to accelerate the expansion of transport demand. At present, cross-border freight traffic is growing by 2 - 3% per year. The modal accommodation of this demand is an unsolved issue of fundamental importance. A road-only scenario implicates an unacceptable environmental dimension because it would allow congestion to get worse. Moreover, the ability of road transport per se and its infrastructure to accommodate the expansion is also questionable.

Seeking an efficient solution, EU policy proposals acknowledge the importance of using more than one transport mode during the transportation process, the “integrated transport system” concept. The Community would save 15 ECU per freight tonne in an average 1,000 kilometre journey if the transport traffic was transferred from road to combined transport, while similar savings would be achieved by a transfer to railroads (European Parliament, 1991). To achieve the completion of an integrated system serving a wide geographical space, the exploitation of the potential of each mode of transport in each market segment is essential. At present, both infrastructure development and networking are clearly inconsistent with these needs. Satisfactory modal shift and safe transportation are impossible as effective connections are absent. Significant resources are essential to encourage the desired greater use of maritime routes, inland waterways and railroads, and the achievement of an integrated multi-modal network.

Investing in Transport Infrastructure: The EU Contribution

The European Commission is committed to finding feasible solutions to the financial difficulties, especially as ITI demands are at least twice the currently available resources. Over 400 billion ECU are required for the period up to 2010 to modernise transport infrastructure and avoid the networks’ saturation, but the total investment involved for transport infrastructure projects by the end of the century amounts only to 82 billion ECU (CEC, 1993). Therefore, substantial benefits are obtained from current attempts to introduce a Community framework targeting the mobilisation of other capital resources, and their redirection towards long-term investment in transport infrastructure. Apart from direct co-finance of the projects, these attempts implicate interest subsidisation, budget guarantees, fiscal ambiguity, and mechanisms to promote their self-financing.

The European Investment Bank (EIB) and the European Regional Development Fund (ERDF) have been the major EU institutions promoting the substantial EU involvement in financing transport infrastructure. EIB finances transport infrastructure projects by supplementing equity capital or loans. This autonomous nonprofit EU institution allocated 7 million ECU to the transport sector the period 1987-1991. The ERDF granted 8.787 million ECU during the period 1975-1988, to improve transport infrastructure in lagging regions. From 1988, the year of their reform, until 1993 the EU Structural Funds granted 5.584 million ECU for the funding of transport infrastructure projects in the more peripheral regions, mainly through the Community Support Framework. Complementary projects are financed in the context of other programmes like Interreg and Regis which, respectively, target inter-state co-operation and the financial support of the isolated islands on the Community’s periphery.

In 1992, a new financial framework for the period 1993-1997 was agreed (CEC, 1992b). It extended the existing budget lines for European infrastructure investments, especially in the framework of ERDF and
EIB. In addition, it instituted the Cohesion Fund, an initiative that had been agreed in the Maastricht Treaty and provides resources to cover infrastructural needs of the lagging EU regions, as well as the European Investment Facility.

Nevertheless, even if the EU was able to provide the necessary capital, the prospect of them replacing national governments or the private sector as the main source of funding for the improvement of transport infrastructure would not be desirable. The goal of EU financial intervention is the co-ordination of local, national, and regional policies in line with the principle of subsidiarity and within a multi-modal and sustainable perspective (CEC, 1992c). Its contribution is to identify the missing network links in the lagging regions, to support the launching of major projects and to supply a financial impetus to national investment programmes which pursue the development of the transport infrastructure.

The significant capital mobilisation provided by EU investments, either loans or grants, is a requirement to accomplish the aforementioned objectives. However, the aggregate ITI in the EU declined from 1.5% of GDP in 1975 to 0.9% in 1980. The decline was halted at the beginning of the 1980s when investment settled at 1% of GDP (ECMT, 1991). In 1993 expenditure on transport infrastructure in the EU was 0.8% of the GDP (CEC-DG Transport, 1994). The result of this trend were rigidities, procedural slowness and malfunctions; all phenomena that are frequently blamed to be among the causes of Europe’s decline in competitiveness. So neither EU support for specific projects nor loans provided through the EIB and the ERDF managed to interest private sector investors. Thus, EU policy failed to maximise the efficiency of the provided financial assistance through the selective choice of its modal distribution.

The inefficient utilisation of limited resources is evident when investment in port infrastructure (IP) is examined. The nodes of multi-modal transport chains are an inseparable part of the network. They are the terminals of the transportation process, and the connection points that facilitate modal interchange and the realisation of a continuous freight and passenger flow. Whenever a seagoing leg is part of the transportation process - e.g. sea-land, sea-sea (feeder), or sea-inland waterway - the critical nodes of the chain are ports.

While a growth in demand for port services has been observed, the level of IP (including new construction, expansion, reconstruction, and renewal of infrastructure) is declining, whether it is expressed as a share of the total ITI, or as a percentage of GDP. Although there are fluctuations on a year-to-year basis, the relative size of the investment in all the transport modes other than pipelines in the 1980s indicates that the share of ports and inland waterways has decreased from 5% to 3.5% and from 2% to 1.5% of total investment respectively. On the other hand, over 60% of all investment went to road infrastructure (with a slight downward trend) while the share of investment allocated to railroad infrastructure increased slightly to about 23%. Airports have benefited from the redistribution of investment and their share increased significantly from 2.9% to 5.6% (CEC, 1992a).

Although it is not the only cause, allocation of these investments has contributed to altering freight traffic modes within the period 1975-1988. Whilst the level of goods transport in the EU increased from 630 million tonne-kilometres to 1026 million tonne-kilometres, growth by mode was not evenly shared. Transport by road increased from 58% of the total European volume to 74%, while transport by rail decreased from 12% to 10%, and waterways’ share plunged from 27% to 16% (European Parliament, 1991).

Almost all of the substantial traffic volume increase which has taken place has been absorbed by road transport. Among the main factors that advanced this spontaneous and distorted development is the unequal distribution of investment among the different transport modes. To counterbalance this outcome structural changes should take place targeting the redistribution of the modal pie, and the substantial increase of the ITI. The European Parliament has already suggested investments in road links should be a maximum of 25% of total ITI, and the respective rail and maritime shares should be increased substantially.

The Greek Case

The absence of basic port infrastructure is not a generalised problem within the EU, although further modernisation is essential. Largely because of competition, even among European ports within the same country, most of them have the ability to cover basic infrastructural needs. The circumstances in some EU regions, and especially in Greece, differ remarkably. Despite the significance of
Greek ports for the reloading of cargoes and their distribution in the mainland and the islands, the renewal of their infrastructure has been problematic. Serious shortcomings include the lack of connections with inland transport networks, and the absence of key facilities to match the rapidly growing demand for fast and reliable freight transport - i.e. container terminals and roll on/roll off facilities, transshipment installations, electromechanical equipment, skilled personnel, and inland transport infrastructure inside the ports.

Among the constraints that have lead to the absence of necessary investments are the restraints of the public budget and the generally limited ITI. During the period 1981-1985 ITI was 0.625% of GDP (Figure 1). For the second half of the decade this was 0.627%, still lower than the average EU level of respective investments. But ITI rose to 0.781% of the GDP during the period 1991-1994, to a great extent as a result of the first Community Support Framework which allocated substantial EU funds to basic infrastructure in Greece.

On the contrary, the percentage of GDP invested in port infrastructure continues to decline. This percentage was 0.033% of the GDP for the first five years of the 1980s and declined to 0.030% during the second half. A further decline to 0.026% of GDP was observed for the first four years of the 1990s. The most unsatisfactory development is that the size of the relative share of the ITI which was devoted to port infrastructure projects in the first half of the 1990s is lower than at the beginning of the 1980s (Figure 2).

The apparent fall of IPI jeopardises the competitiveness of the sector and makes inefficient any other measures in a policy designed to guarantee the expansion of the mode’s use (Chiomoudis and Pallis, 1996). It contradicts the country’s morphology, and the widespread view that whereas the ports are included in a reliable transport system they contribute substantially to reducing core-periphery imbalances. Moreover, the condition of the infrastructure contrasts with the contemporary trend to replace traditional forms of cargo distribution through inter-modal transportation. Major improvements in infrastructure are essential to overcome less efficient facilities, and to unlock the potential for modal integration in logistics which characterise modern traffic flows.

Whether Greek ports will manage to introduce these changes, and thereby advance their capacity and productivity, is largely dependent on available funds for infrastructural investment. Of course, administrative and organisational changes remain prerequisites for the optimum exploitation of such investment, as they facilitate the maximisation of benefits from infrastructure operation.

These developments would not be so unsatisfactory if the aforementioned trend had been offset by a substantial increase in investment in railways, the other mode that has the potential to promote sustainable mobility. Greek railways are underdeveloped and of mediocre quality. Only 10% of the oldest, and probably most counterproductive transport network in the EU is twin-track and only 3% is electrified, while the respective EU levels are 43% and 40% (CEC, 1995). However, investment strategy audits confirm that these problems have been neglected. While forecasts emphasise a substantial increase in demand, especially for the emerging integrated transport concept, there is only a modest increase in expenditure on railroad infrastructure (Figure 2).

Significantly, the aggregate share of investment in maritime and rail transport in
The Effects of the Emerging EU Financial Contribution

The questions that arise is whether, and how, the EU financial initiatives influence the investment strategy. The first Community Support Framework, which started in 1989 and ended in 1993, has been an important development. It attempted to encourage the economic convergence of Greece with the rest of the EU through an infrastructure investment programme. Its unambiguous evolution, at least as far as the Greek case is concerned, was the rise of total public investment in infrastructure. Since 1990 almost 60% of the total investment devoted to infrastructure in any transport mode has been via EU financial contribution (Figure 3). Consequently, after a long period of underinvestment, expenditure on ITI in Greece increased, although it still falls short of the EU average.

What EU financial intervention has not managed to do is to promote a more rational modal distribution of investment, which would advance the modernisation of environment-friendly modes and the balanced integration of all elements of the transport network. Despite the rhetoric, the EU perception of the development of a transport network is dominated by its role in making the Single Market work (Masser et al., 1992; Whitelegg, 1993). In fact, despite the infrastructural and environmental necessities, the EU has avoided confining itself in a policy of rigid lines of port infrastructure that should be constructed within a certain time because a defined plan of a strategic, or priority port network would distort competition within the sector, a decision highly appreciated by the industry (Pallis, 1997). Remarkably, although the share of funds in the second Community Support Framework (1994-1999) allocated to developing transport infrastructure in Greece (including Athens Underground) increased from 20% to 30% of the total, there is no indication of a potential redistribution of their modal allocation. The EU initiatives lack a transport dimension which would offer alternative scenarios to achieve its objectives.

However, it would be a mistake to attribute the road-addicted investment strategy solely to deficiencies in initiatives undertaken by the supranational EU institutions. The EU approach is to implement a bottom-up decision making approach in line with the subsidiarity principle. Member States plan their own national infrastructures with reference to EU priorities. They also have to decide the timing and pace of construction of projects, and determine financing strategies based on the mobilisation of as much capital as possible.

The fundamental characteristic of the Greek investment strategy is to attempt to develop cheap transport links as fast as possible, to compensate for a long period of underdevelopment, and to end the country's peripheral status. This fosters motorway-biased investment priorities. In addition, there are difficulties to identify and evaluate the possible benefits from the construction of specific infrastructure projects. The fact that the assessment of the environmental impacts of transport investment policies, plans and programmes are not well developed (Chadwick & Gleave, 1996) is an additional explanation of the uneven distribution of the available funds. Moreover, an inflexible institutional framework exists - complex and non-transparent rules, regulations and procedures are applied in planning, evaluating and constructing all infrastructure projects - and this has negative effects on the rapid absorption of available EU funds. When the myopic EU perception joins short-sighted national policies of transport, such as those of Greece, the result is the stimulation of negative, and disastrous long term investment patterns.

Finally, the absence of investment incentives, which would mobilise significant private capital towards rail or port projects, should not be underestimated. Most infrastructure projects have features which are unattractive to private investors, for instance they do not generate cash flows that
would serve loans and pay the return on equity capital. In conjunction with the characteristics of the regulatory framework, they create a negative environment and limit the involvement of the private sector.

Conclusion

The EU has embarked upon an ambitious project to create a trans-European transport network which will satisfy the socioeconomic needs of the Union. In this perspective, the selective distribution of investment in infrastructure is an influential parameter of the final outcome, as it can generate new traffic and induce modal choice. However, since the beginning of the 1980s a road-biased redistribution of the aggregate European ITI is taking place. The share of investment in the most environment-friendly elements of the network follows a negative trend.

This is particular true in the case of Greece, where under investment and modal priorities characterise the national level policies. The importance of modernising both rail and maritime transport has been neglected. Even though the substantial EU financial contribution increased the level of investment in transport infrastructure, it has not managed to alter the unsustainable modal priorities. The latter has been a product of the negative institutional framework in Greece, the features of the infrastructure projects per se, and the lack of alternative EU scenarios to facilitate the objective of integrating an environmental dimension into its transport policy. In the short term this policy pattern adversely affects the distribution of traffic volume and the competitive position of less developed transport modes. In the long term it negates the integration of transport networks and undermines the concept of sustainable mobility. The fast development of all infrastructure transport modes remains the only way to integrate them in a multimodal perspective and must be a strategic consideration of the current Common Transport Policy. Investment policies have to come to grips with these problems.

Considering that the level of goods and passenger transport is expected to grow rapidly in the foreseeable future, policymakers at a national, regional or European level must recognise in practice that railroads and waterways should progressively attract more business at the expense of congested and less environment-friendly road transport.

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Wrestling with the Octopus - New approaches to tackling traffic and sprawl

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Abstract
At both sides of the Atlantic Ocean urban sprawl is characterised by many of the same features. Governments in both Britain and the U.S.A. are tackling it with various policy instruments in the form of carrots and sticks, although the balance is open to question.

Keywords
Traffic, Urban sprawl, U.S.A., U.K.

Introduction
The twin problems of traffic congestion and urban sprawl are one of the defining features of the late 20th century. As long ago as 1928, Clough William-Ellis wrote England and the Octopus - a passionate tirade against uncontrolled roadside ribbon development which, even then, was spreading its tentacles ever further into the English countryside.

'...It is this uneconomic 'ribbon development' along the main roads that is so rapidly destroying such country amenity as is still left near our growing towns and we are doing little or nothing to combat it. The disfiguring little buildings grow up and multiply like nettles along a drain, like lice upon a tape-worm.'

For William-Ellis, it was not only the direct loss of valuable farmland that was at stake, but the erosion of the cultural identity of ancient villages and the aesthetic damage to the landscape caused by garish billboards and other symbols of modern, urban development spreading through the countryside.

Today, on both sides of the Atlantic, the tide of car-dependent development continues. People are becoming locked into lifestyles which not only draw heavily on limited environmental resources (clean air, open space, tranquillity), but which are also increasingly recognised as constrained by their reliance on the car and the nature of suburban development. The isolation of the suburbs, the amount of time required for travel and the lack of community fostered in bland, generic developments are important factors acting to lessen people's quality of life.

But the continuation of these trends is not inevitable. In both Europe and America there are signs that a new approach is underway - one which will help to reduce our dependency on the car, and by doing so, to reduce the environmental impacts of transport while boosting the vitality of our villages, towns and cities. This paper examines the motivations for such change, the hurdles we face in making progress and draws on experiences in the UK and US that help to show new ways forward.

Transport and land use policy in the UK
Over the last 50 years the English countryside has experienced an enormous degree of change. New development, of a scale and type never previously experienced, has fundamentally changed the character of many rural areas and ushered in new ways of living in the countryside. Underlying these changes lies the fact that three hundred people have left England's major cities each day for the past 20 years. They have left behind urban areas where over 600,000 hectares of land lie vacant. In turn, green fields totalling as much as 11,000 ha have been urbanised every year (Sinclair, 1992).

Linked closely to these changes has been the growth in our dependence on the car as the major form of transport. Since 1970 the average annual distance British people drive has almost doubled to 10,400 kilometres. There has been a steep decline in the distance walked or cycled, with three-quaters of all journeys between two and five miles (3.2 km - 8 km) now being made by car (DoT, 1996). The experience of the UK, therefore, has been one in which the growth in affluence and car ownership has corresponded with a flight from the cities to the suburbs and beyond. The ensuing spread
of low density development has fuelled car dependency, which in turn, has fuelled traffic growth.

Two steps forward

Groups such as CPRE have highlighted the environmental consequences of these trends for many years (e.g. see Matson and Burton, 1996). It was not until recently, however, that the UK Government took steps to introduce new policies to tackle the interrelated issues of traffic and sprawl. The publication of Planning Policy Guidance note 13: Transport (PPG 13) marked an important milestone in the development of land use and transport policies in the UK. The aim of PPG 13 is explained below:

'By planning land use and transport together in ways which enable people to carry out their everyday activities with less need to travel, local planning authorities can reduce reliance on the private car and make a significant contribution to the environmental goals set out in the Government's Sustainable Development Strategy.' (DoE/DfT, 1994, Paragraph 1.3)

At last, here was Government policy advocating the importance of reducing the need to travel and highlighting the necessity of making more efficient use of land resources. There is a new emphasis on locating more development in existing urban areas where a range of services are available and where people have greater opportunity to get about by public transport, bike and foot. For the first time, the role of land use planning was identified as a legitimate tool in tackling transport problems.

In addition to PPG 13, the UK Government also introduced measures as part of its climate change strategy to address the costs of road travel. The strategy includes a commitment to increase the costs of road fuel duties by at least 5% above the level of inflation each year, for an unspecified period of time. Although, many commentators (including CPRE) argue that this increase in cost will be insufficient to bring about significant changes in driving behaviour, it is acknowledged as a step in the right direction.

Steps back

The success of PPG 13 in practice inevitably relies on other aspects of transport policy too. The relative costs of road travel and the availability of alternative forms of transport are crucial adjuncts, while local government has a pivotal role in reflecting the guidance in day to day decision-making.

While positive change is underway in the UK, several 'blockages' to progress can be identified. These include:

- Apathy in local government - there is a perception in some areas of local government that PPG 13 is too little, too late, and that the influence of changing development patterns will be insignificant in comparison to other forces encouraging people to use their cars more often;
- Limitations in local government power - can mean that local governments are less able to support land use strategies with other compatible actions - such as raising the costs of travelling by car relative to the price of public transport fares;
- Local government competition - competition between local governments for economic development can override environmental considerations, such as the need to reduce parking levels or to protect greenbelt land;
- A powerful development community - which seeks to overturn restrictions on traffic-generating development and which is often unwilling to take on the perceived risks of developing in new areas (such as inner city areas);
- A lack of conviction at all levels - from the general public to national government - that we really can reduce car usage and that public transport or walking and cycling offer a viable alternative;
- The costs of change - increasing financial constraints on local authorities' transport budgets hampers the development of alternative transport solutions.

The purpose of this report, therefore, is to explore the lessons that US transport and land use practice might offer for decision-makers and communities working to overcome these problems in the UK. Conversely, it looks at what messages US policy makers might take from the UK experience of land use and transport planning.

Transport and land use policy in the US

In the US - home of the car - it is little surprise that the trends in land use and transport in the UK described above can also readily be seen - but even more so! In most areas, suburban new development is the norm and in many states vast areas of land have been - and still are being - devoted to low density development, where the different
types of land use (e.g., employment, retail, residential) are clearly segregated and only accessible by car. In the Chicago region, for example, between 1970 and 1990 the population grew by 4%, but the urbanised area increased by a stunning 55% (Grimshaw, 1996). In the Denver area, over 36,400 ha of land are being consumed by new development each year (National Geographic, 1996), while Phoenix, Arizona grows at the rate of 10 ha each day (Newsweek, 1995).

The transport consequences of modern American sprawl development can be seen in the travel trends. Compared with British residents, Americans drive twice as far each year (20,800 km) (Benfield, 1995). This difference is explained less by the fact that Americans make longer car journeys (in fact the average US car trip is only slightly longer than the average UK car trip (Shipper et al., 1995)), and more by the fact that they make a greater number of journeys altogether (average of 11 per capita every week). As Schipper et al. state: ‘the lack of walking and cycling trips in the US contrast with figures for the other countries, suggesting that Americans drive for many purposes for which Europeans walk.’

As a result, the US consumes more than one third of the world’s transport energy (Benfield, 1995). Environmental problems such as air pollution and the depletion of natural resources, such as drinking water and farmlands, are just some of the negative consequences of the growth in sprawl and traffic. There is also a growing recognition of the social problems that can be created by modern development and the substantial economic costs inherent in having to serve a diffuse road-based development patterns. The disillusionment with the quality of life available to many people living in the modern suburbs is an increasing source of public debate as evidenced by Newsweek’s special issue (15th May, 1995) entitled ‘Bye-Bye, Suburban Dream - 15 ways to fix the suburbs’.

New policy directions

In tackling such problems in the US, the most significant national policy developments have been the revision and strengthening of the Clean Air Act in 1990 and the introduction of the Inter-modal Surface Transportation Efficiency Act in 1991 (ISTEA). The aim of ISTE A, in particular, is:

‘to develop a National Inter-modal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner.’

Together these Acts have sharply focused attention on the problem of emissions from the transportation sector. The Clean Air Act provides a powerful legislative framework to ensure that local governments take action to address air pollution problems in their areas. In turn, ISTE A provides the means to implement less polluting transport solutions through transport funding from national to local governments. In the implementation of these pieces of legislation there is a recognition of the important role land development will play, although the power of national government to influence land use is severely limited.

At state and local levels there are also a wealth of initiatives underway. Some aim to involve communities in identifying new visions for development, others involve new plans for public transport or examine the fine detail of urban design to promote more pedestrian and cycle friendly environments. As in the UK, the general focus is on promoting more traditional (denser) forms of development which are carefully designed to provide a range of services and activities within reach of each other and where public transport, walking and cycling are promoted as attractive alternatives to using the car. Above all, it is about creating ‘liveable places’ which offer people something more than simply an address to call their own.

Trips - and stumbles

While ISTE A is widely hailed as a major step forward, the reality of implementation (as with PPG 13 in the UK) has highlighted a number of problem issues. Interestingly, many of the ‘blockages’ to achieving more transport and energy-efficient development in the UK highlighted above, are also manifest in the US. For example,

- inertia in local government - State Highways Departments seem unwilling to abandon long-standing ‘favourite’ road building plans and much of the federal transport budget for local government continues to be spent on highway improvements and maintenance;
- limited local government powers - in several States (e.g., Washington) the spending of local fuel taxes is constrained...
by Constitutional provisions which require that these moneys are spent for highway purposes alone, thereby ruling out their use in funding public transport alternatives;

- **local government competition** - competition between local governments is fierce to attract development which will boost property tax revenue. In the absence of a regional land use planning framework in most areas, it is extremely difficult for local authorities to risk pioneering growth management plans. In the Chicago region, for example, there are over 270 local government jurisdictions!

- **the power of the development community** - in states such as California the development community is a powerful financial and political force which can act to stall efforts aimed at managing growth. There is also a broader movement of people representing the inviolability of property rights who are active in opposing action which may limit rights to the development and use of private land (e.g. 'Property ownership was the keystone of liberty, and who was the slum landlord but that quintessential American, the property owner? Don't tell me what to do with my land!' Kunstler, 1993, p. 36);

- **lack of conviction** - political fear of increasing the costs of travelling by car is widespread (as in Europe) and the existing low levels of public transport patronage highlight the difficulties of motivating modal shift in future;

- **the costs of change** - as in the UK, the costs of developing new transport alternatives are seen to be prohibitive. Proposals for public transport schemes often require a local ballot to approve funding through tax increases. Cities like Seattle have experienced difficulty in winning voter support for such initiatives in the past.

**Motivations for change**

On both sides of the Atlantic, therefore, there appears to be a growing awareness of the damage that has been inflicted on the natural environment and our communities by the twin problems of traffic and sprawl. It is interesting to note that while the need for change may be widely recognised, the specific motivations for change differ between the UK and the US and, indeed, between different parts of the US. In the UK, for example, the motivations behind PPG 13 can primarily be seen to be the need to reduce CO₂ emissions from the transport sector. Arguments that environmentalists and others had put forward for many years about the need to conserve finite land resources from sprawl development and to protect the High Street (akin to the US ‘Main Street’) from powerful out-of-town retail, suddenly gained new political urgency in view of international agreements to stabilise CO₂ emissions.

In the US, CO₂ emissions or the loss of land resources, do not seem to have played such a pivotal role in motivating policy change. In contrast, the need to tackle air quality problems appears to have been a more powerful political ‘driver’. In addition, individual states each have their own environmental issue which resonates with the public. In Washington State (and more widely in the North West), for example, this centres around the health of the native wild salmon species in the region’s rivers. Oregonians talk of the ‘second Oregon paycheck’ - referring to the quality of the environment as an extra bonus to living there. In Colorado, the ability of residents living in the Denver region to see the Rockies unmarred by a brown cloud of pollution is seen to be a key indicator of local environmental quality.

**Lessons**

Recognising the different underlying motivations for policy change is helpful in explaining the variations in policy responses that can be seen in the UK and US. Translating different policy ‘lovers’ and tools from an American to British context (and vice versa) offers new opportunities to motivate change and the possibility of helping us to break through some of the ‘blockages’ described above that currently hinder more sustainable patterns of living.

The absence of a national framework for land use planning in the US limits the opportunities for introducing nationally-driven policy mechanisms such as PPG 13. In its absence, however, many different initiatives have been developed which are aimed at achieving similar goals. Some of those which seem most relevant to policy debates in the UK are discussed below.

**Growth management measures**

Growth management is a politically sensitive issue in many states and this limits the opportunities for tightening land use controls or introducing urban growth boundaries. However, some states - Washington and
Oregon, in particular - have introduced Growth Management Acts and urban growth boundaries have been established around cities like Portland. Defending these mechanisms against those who would seek to weaken them is an on-going battle. With time, however, it is becoming clearer that growth management can play a crucial role in strengthening the local economy by ensuring that the quality of the environment is maintained as an asset attracting new investment. As the economies of cities like Portland and Seattle thrive, the logic of growth management becomes increasingly convincing.

**The costs of sprawl**

A key dimension to debates about sprawl in the US, is the focus on the costs inherent in such low density forms of development. A number of studies (e.g. Diamond and Noonan, 1986) have been completed or are underway which seek to quantify the total costs of sprawl development by examining the costs of installing new utility services (such as electricity, waste and water), new infrastructure (e.g. roads and schools), services (such as the fire and police), as well as some of the wider environmental costs. From this, the costs of new development can be weighed against the future benefits to local government which will be derived from the generation of new local tax revenue.

In many cases, it is estimated that new development is not paying its way and that in effect, new suburban development is being subsidised by existing urban residents and creating a heavy financial burden for the future. The seriousness of this impending fiscal crisis has brought important new players into the debate, such as the Bank of America who, together with the California Resources Agency, the Greenbelt Alliance, and the Low Income Housing Fund, produced a report which stated that: 'unchecked sprawl has shifted from an engine of California's growth to a force that now threatens to inhibit growth and degrade the quality of our life.'

Concluding that sprawl 'is a luxury we can no longer afford' this report and others provide a convincing new case for action.

**'Smart growth'**

Linked to discussions about the cost of sprawl, is a new emphasis on the need to promote 'smart growth'. Among others, the American Planning Association and the US Environmental Protection Agency are promoting smart growth concepts which emphasise the economic benefits of developing in a resource-efficient manner. In addition to the use of land use planning mechanisms to guide such development, a range of economic incentives are being explored which aim to promote development and lifestyle choices which are more resource-efficient and reduce car travel.

A good example of such work, is the development of the concept of the 'location-efficient mortgage'. This initiative is based on research in Chicago, Los Angeles and San Francisco which examined the differences in household expenditure between areas which were either well-served or not by public transport and other services. It was found that in areas rich in public transport and shops, banks and other services, households spend between $350 to $390 less each month on travel. Mortgage companies are now being encouraged to take this factor into account when estimating how much they are prepared to lend. By making an extra increment of money available to buyers who are looking in transport-efficient locations, mortgage companies can increase the attractiveness of the property market in these areas and highlight the positive benefits of choosing less car-dependent lifestyles.

**Transit-orientated development and the New Urbanism**

While UK towns and cities have often planned new development in relation to public transport nodes, the implementation of transit-orientated development projects in the US offer lessons in design and detail. Transit-orientated developments (TODs) have been popularised by architects such as Peter Calthorpe and implemented in places like Portland, Los Angeles and Chicago. Using neo-traditional design principles, TODs aim to create places which include a fairly dense mixture of building types (e.g. housing, shops and businesses), promote an equally diverse mix of people and activities, and which are pedestrian friendly and closely linked by public transport services.

In some cities transit-orientated development proposals play a major role in land use and transport policies. For example, in Portland the aim is to secure a 5% reduction in traffic emissions over a 20 year period through TODs. In working towards such goals, the level of detail and consistency in implementation is important. For example, land use densities in Portland are managed to locate 'the highest densities in the Downtown and along potential and existing transit corridors'. In addition, there
are limitations on the amount of ground level blank wall allowed on downtown buildings to create a more interesting pedestrian environment. Other work has gone on to promote walking by widening sidewalks, improving lighting and planting trees. Some of this work has even been supported by Congestion Management and Air Quality funding available under ISTEA, which more usually goes towards traditional traffic management initiatives.

Concepts of New Urbanism, promoted by architects like Peter Calthorpe, Andres Duany and Elizabeth Plater-Zyberk, have resulted in the building of a number of high quality developments across the US. These are characterised by a mix of types of building, built at fairly high densities (e.g. terrace or ‘row’ houses). Attention is given to providing attractive sidewalks, footpath links between different areas and to the development of a focal point, such as a village green. The meticulous attention to detail in many of these developments help to reinforce the positive image of TOD development and boost the wider public appeal of new styles of living.

Taxes and tax relief

Local governments in the US have considerable discretion in introducing taxes and tax relief initiatives designed to serve local goals. An example - once again drawn from Portland - is the provision of tax abatements lasting up to 10 years for businesses which carry out redevelopment in the city centre. Consideration is now being given to extend such abatements to investments made on properties surrounding public transport nodes.

At a national level, Low Income Housing Tax Credits have been made available. These allow businesses who diversify into the provision of affordable housing to offset these investments against their general taxes. As a result there has been a significant increase in the availability of funding for local community development corporations. In Los Angeles, use is also made of the existing sales tax to help fund public transport in the region. Here, one percent of the local sales tax is earmarked by law for the funding of the public transport network - helping to provide a sound resource base for the service.

Community problem-solving

The importance of developing policy actions on the basis of community involvement and consensus holds a position of high importance in the US. Different approaches to getting people involved in ‘visioning’ processes and community planning are often imaginative and exciting in comparison to more traditional methods of public participation used in the UK.

One interesting initiative is the PLACE’S project (PLAning for Community Energy, Environmental and Economic Sustainability). PLACE’S is a computer-assisted method to promote design of sustainable communities. It uses a comprehensive set of energy-conscious urban design and growth management measures applicable in a wide range of conditions. The method consists of three elements: a modelling tool to measure the total energy and air quality impacts of different growth patterns; a methodology for sustainable urban design; and community involvement techniques. Through a series of meetings between the community, local government and the project consultants, local problems and trends are identified and future scenarios discussed. The technical information and modelling tool can be used as a basis for looking at future development scenarios, including the outcome of continuing with the business-as-usual approach, as well as the results of opting for more energy-efficient development patterns.

While such detailed local planning processes can be time consuming, the case study results to date are encouraging. In general, local communities favour energy-efficient development forms when offered the chance to analyse a range of development options. The indications are that energy-conscious development can reduce per capita energy use and pollutant emissions at the neighbourhood level by as much as 50% below conventional business-as-usual designs.

English lessons - too many carrots, not enough sticks

Many of the approaches described above are fresh to UK land use and transport practice and offer exciting opportunities for change. In turn, however, there are lessons that the UK may have to offer the US. Perhaps the most significant of these, is the importance of the relative costs of different transport modes in influencing transport choices.

There is an understandable unwillingness in the US to address directly the costs of driving, either by raising fuel taxes or through parking controls, congestion charging and other fiscal mechanisms. Rather, the focus for tackling traffic and
sprawl seems to be more about creating places where a mix of services and transport options are available to reduce people’s need to use a car. It is, of course, easy to understand why politicians and others are wary of action to raise the costs of car use. But the experience of the UK, suggests that land use planning and public transport alone will not stem the tide of traffic growth or people’s desire to use the car. As Susan Owens put it, ‘planning can change morphology but not motivation’.

Over the last 20 years, the UK has seen a steady rise in the length of average journey and in the proportion of journeys made by car. At the same time, the real costs of public transport fares have increased faster than the growth in incomes, while the real costs of motoring have fallen. Driving is therefore more affordable now than it was 20 years ago and despite recent increases in fuel duty, public transport is still relatively much more expensive.

Some of the travel trends discussed in this paper can be explained by the growth in low density, car-dependent development and the decline in public transport. But it also has to be recognised, that the choices people make when moving to low-density locations which depend on car access, are influenced by the cost of driving to and from such destinations. In short, tackling the ‘octopus’ of urban sprawl and traffic growth will require governments at all levels, and on both sides of the Atlantic to embrace not only the need for new land use policies and better public transport, but also the relative costs of people’s travel choices.

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When is a car NOT a car?

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Abstract
Co-operative Auto Network, as the name suggests, is a car sharing operation in Vancouver, Canada. Most members have dispensed with a car and use the co-op to provide them with private mobility as and when they need it.

Keywords
Car sharing, Canada, Co-operatives

Introduction

Premise A: The rapid increase in car numbers and vehicular kilometres travelled with their social, economic and environmental costs are heavily taxing our communities, cities and planet.

Premise B: Many people recognise Premise A but persist in owning a car because of those times when they really need one. These are times when cost, access, convenience and time considerations make any other option undesirable or impossible.

Premise C: When people persist in owning a car, they will use it - and will either use it to the exclusion of alternatives or at least far more than the availability and utility of alternatives would require.

Therefore: If we supply people with what they need in a system which will mitigate against frivolous use and abuse, the individual will be satisfied and the community will be spared the social, economic and environmental costs.

With car sharing we recognise the need to drive while we work to eliminate dependence. Car sharing provides a low cost 'carrot' for people to access cars, while providing a self-modulated 'stick' to eliminate auto-dependency. This is the operating principle of the Co-operative Auto Network - or CAN.

Co-operative Auto Network: the rationale

The truth of the loosely-formed syllogism above is not much more than common sense. The alternatives don't do the whole job and once money has been invested to purchase a vehicle the buyer will tend to feel compelled to use it. People will use a car or the alternatives - rarely both. Furthermore, there is a suggestion that it is cheaper to drive. The economics of auto ownership as it now stands reinforces the separation of car costs into two realms: the cost of owning and the cost of using. This means after financing the sticker price, buying insurance, tyres, and parking, plus paying any maintenance bills, the owner associates these expenses and thinks getting to the hockey game will cost only the gas to get there and parking if he can't find a free spot. This construct is entirely false but once the car is 'paid for' it often seems to people that driving isn't as costly as taking the bus - and they do the trip in half the time. So using the car for every transport need becomes the economically-reinforced norm, rather than the mode of last resort.

With car sharing through CAN, we answer the need for the occasional use of a car while we restate the psycho-economic relationship of car use. We have reversed the economic argument. CAN makes it cheap to 'purchase' a nice-looking car which is convenient and maintenance-free. Then we make every kilometre driven and every hour used have a cost. This works to limit vehicular kilometres travelled and completely eliminate many trips. The Co-operative Auto Network opens the door to practical alternatives to the car's overuse and encourages its members to walk or cycle, and take the bus or a taxi more.
Car Sharing - The background

The first car sharing organisations were founded in Germany and Switzerland a decade ago. Present estimates put the number of car shares in Europe at around 100,000 members in 300 cities. Car sharing is already making in-roads in North America. AutoCom and CommunAuto have formed in Quebec, Canada; while the Co-operative Auto Network (CAN) in Vancouver, British Columbia, introduced its service in January 1997. About the same time the Victoria Car Share Co-op launched their service. As of yet, there is no operation in the United States of America, however various organisations have been studying the European and Canadian models to start service in Oregon, Washington, California and Colorado. A new service is also about to launch in Singapore, while Japanese and Korean researchers are putting together their own projects.

Elemental to the car sharing concept is the understanding that many people would like to get rid of their car and walk, cycle, or take transit more, but persist in owning a vehicle for those occasional times when using a car is really the only alternative. It doesn’t take much of a stretch to say that if they have a car, they’re going to use it - perhaps more frequently than is really necessary. Getting one’s money’s worth from the investment typically means driving is the most economical option for getting around.

Or at least so it seems. Cars make a pretty large dent in the budget of most people who own one. Changing the nature of how we view the expenses incurred by driving will begin to help change the reliance we have on automobiles.

Changing this viewpoint of a vehicle as an article one must have, to the understanding that it is mobility which is needed, is key to car sharing. The idea isn’t such a radically new one either. Car sharing, in principle, has been going on in families and between friends for as long as there have been cars. As a co-operatively incorporated entity though, it started in the German neighbourhood of Kreuberg in 1988. Brothers Markus and Carsten Peterson, along with a few friends, got together to share the ‘guilt’ and expense of car ownership. Their incorporation took place after over two years of research and tests. They called themselves StattAuto (which translates as Instead of Cars) but sounds like StadtAuto (translation: City Car). Both translations will describe the best use and intent of the organisation.

By December of 1990, StadtAuto was accepting at least one new member a day. The following two years saw the membership go from 500 to 1000 people, while across Europe as many as 300 cities have started co-ops of their own. In the summer of 1994, there were 3000 car-sharers in Germany alone. Most recent figures put the number of car sharers at 100,000 across Europe. The many co-ops and clubs are now linked by European Car Sharing, an organisation funded by the European Union that allows for car share cross usage throughout the various cities. For example, a member in Berlin, Germany can travel by train to Lucerne, Switzerland and use a car there.

Travelling by bus or train from city to city demonstrates a strong commitment to car sharing. It tends to work best in dense urban centres with a well-established transportation infrastructure where access to shops and services is nearby at hand. This is because working with the established transportation links - from trains to taxi cabs - is not just beneficial to car sharing - it is mandatory. In these areas, car sharing is able to foster the notion that members can commit to walk, roller blade, cycle, take transit, or taxi cab, before choosing to reserve a vehicle for short term obligations. For longer trips, trains, carpools and rental companies are perfectly situated in the network to meet the needs of members. Car sharing is then seen as a ‘missing link’ in a transportation chain.

The concept is not completely new to North America. In 1993, the Province of Quebec sponsored the development of the successful and highly regarded co-operative AutoCom in Quebec City. A sister organisation in Montréal, CommunAuto Inc. is proving to be just as valuable. The early results of these organisations are very promising and are showing every indication of the success enjoyed by their European counterparts. Meanwhile, both Vancouver and Victoria can boast of budding car sharing organisations. Both organisations run under a not-for-profit status and are receiving a great deal of support and attention. They look to be well on their way to the overwhelming successes of the preceding models.
The Need for Car Sharing

In Vancouver we continue to experience rapid growth, as is the case in most urbanised areas around the world. This growth is both in terms of numbers of people moving into a given region and in per capita automobile ownership and usage as well. It is putting a serious strain on our environment, communities and personal finances. Yet, while the transit system is adequate for most of our mobility needs, access to a privately-owned automobile remains a necessity for many people. Car sharing, however, offers a great opportunity to change the way people perceive vehicle access and expense while reducing the reliance we have on car ownership. It can meet the needs of the individual who requires occasional use of an automobile without the inconvenience and high costs associated with ownership. Car sharing pragmatically recognises the benefits of the car while seeking to open the doors to practical alternatives to its overuse.

Interest in the concept, and its practical application is really taking off - for many good reasons. Sustainability has been the catchword of policy-making ever since Gro Brundtland submitted her Commission’s report Our Common Future to the United Nations in 1987. Words like social, economic and environmental have now been cemented to development, just as the three-legged stool of sustainability has become the model for many initiatives. The primary findings of all the conferences, workshops and reports since then has been that the individual has to make the right choices in his or her day-to-day life in order for sustainability to be a reality. This is easy to say but not as easy to do. For our social, economic, and environmental (global) objectives to be met, a lot of hard choices have to be made by people who are reluctant to change, aren’t sold on the necessity to change and aren’t being offered many options to make the difficult changes any easier.

Most people have grown accustomed to a certain lifestyle. Making choices which may limit personal freedoms for more time-consuming alternatives is not going to inspire the radical personal adjustments so needed. Meanwhile, the most damaging element to our ozone, airshed, health and society right now is the same element that most people believe they cannot do without - the automobile. With car sharing, they can ‘do without’ - without losing the access and mobility they need. The option becomes clear; pay less without making huge changes in your life. The individual can potentially save a lot of money by walking a couple of blocks to the car share car, or a little farther to the corner store; while improving air quality, reducing stresses on green space and eliminating some non-point sources of pollution.

Car sharing also creates social benefits for the members. Co-op members will re-connect with others in their community and feel pride in taking action to improve the environment. But, saving time and money aren’t the sole social goals of car sharing. It is also about equity, empowerment and opening access to the fiscally challenged in our community. Sustainability isn’t just about how we can continue in our present path of development while decreasing our destructive impact on the environment. A marked requirement of an improved environment is providing one that is equitable; where everyone has a fair share of the resources available. People of a low income will have the access to a vehicle which has denied them the mobility to get to job interviews and maintain close contact with friends and family.

Joining a car share co-op won’t just assure people’s need to act. It will have positive effects on their bank accounts. The average cost of owning and operating a vehicle for 18,000 kilometres in the Lower Mainland is estimated at $8029.75 CND yearly (Canadian Automotive Association, 1997). The same source calculates a typical mid-sized automobile will cost 49.8 cents for every kilometre driven and that’s only if the car is driven for 18,000 kilometres each year. If the vehicle is driven less, the cost per kilometre increases. In the economics of car ownership, it pays to drive more! This is due to the substantial up-front costs of financing, insuring a car and the depreciation that occurs as soon as you drive off the lot. One pretty much has to drive over 18,000 kilometres in one year to make the purchase break even and drive more to make it worthwhile.

But driving more and farther is not an option. Already transportation is directly responsible for almost fifty percent of greenhouse gas emissions in British Columbia. In the last five years this kind of pollution has increased by 23 percent or if said another way, since 1990 car and trucks in this province are spewing an extra 1,553
million tonnes of particulates into the air we breathe every year. As the percentile growth in vehicles to the Lower Mainland continues to surpass population growth dependence on them grows. Conversely, it is the steady rise in vehicular kilometres travelled, which is overtaxing our airshed. People are living farther and farther away from where they work and opting to drive the span in between more and more. Scenarios like that has the US Environmental Agency forecasting that all of the air quality improvements based on cleaner gasoline and more fuel efficient vehicles will be out-stripped by sheer increase in use by the turn of the century.

Conversely, many other vehicles spend most of their productive life parked. This means the resource is inefficiently used and the pollution generated while the vehicle was being manufactured was almost completely for nought. It is estimated that if every person holding a driver’s license in the Pacific Northwest - from Vancouver down to the tip of Oregon - were to go and get into a car and drive right now, over 1,000,000 cars would still be parked (Durning, 1996).

Shared cars are used more intensively to utilise the full potential of the resource, rather than remain parked for long periods causing congestion in our neighbourhoods. Increased usage and wear and tear on the vehicle will not reduce its reliability as it will be well maintained to ensure a high degree of energy-efficiency. With one car on the street instead of ten, it is easy to say many non-point sources of pollution will be eliminated. Furthermore, the air quality implications of car sharing are huge. Using better maintained cars, while replacing the older vehicles driven for their fiscal sense rather than air sense can have a huge impact on our airshed.

We have pointed to the various assets of car sharing. It is the type of organisation that will put walking, cycling and transit before car use while raising awareness of the transport issues that are encroaching on our well-being, quality of life and ability to live in an environmentally, socially, and economically less stressful way. It will lead to people structuring their lives closer to home, with less economic leakage from their community. Ultimately, car sharing is about options and choice. The option to go where you need to go when you need to get there and being able to choose to get around in a way that reflects your economic realities and environmental sensibilities - and you will even meet your neighbour while you do it.

### Car sharing process - an overview

#### Joining the co-op - requirements and procedures
Joining the co-operative is as simple as producing a valid BC driver’s license. The co-operative may do credit and driver’s record checks as well. An agreement specifying the details of responsibilities and entitlements of the members should be signed by each member. They will have to buy a member share in the co-operative. Typically this is about $500 and is refundable if membership ceases. It is beneficial to have new members commit to a minimum six month period.

#### Car use and billing
The cars have a designated parking area, serving members within a five minute walking distance of their homes. When the car is needed, the member makes a reservation by phone, specifying when the car is needed and for how long. The member then goes to the car and picks up the key from a small lock box on or by the car and before driving away, checks the last logged kilometre entry against the odometer. At the end of the trip, the car is returned to its reserved parking, the journal is completed with the new odometer reading, and the car key is returned to the lock box. Once a month, a bill will arrive clearly stating times of usage as well as kilometres driven. The monthly bill is calculated according to a formula based on these two factors, plus a monthly administration fee.

#### Car location and the reservation process
Cars are placed throughout the community depending on the location of members in that area. As the membership grows, the ratio will increase to at least ten members for each car. Reservation of the cars is made on a first-come-first-serve basis. In the case the nearest vehicle is reserved, the second nearest is checked for availability, then the third nearest, and so on. Occasionally renting a car when demand for co-op cars exceeds supply may be necessary. A relationship with a rental agency would also work well in situations where renting a car is the more economical option for the member.

#### Cleaning, routine maintenance and repair
One important aspect of the co-op is to...
would serve loans and pay the return on equity capital. In conjunction with the characteristics of the regulatory framework, they create a negative environment and limit the involvement of the private sector.

Conclusion
The EU has embarked upon an ambitious project to create a trans-European transport network which will satisfy the socioeconomic needs of the Union. In this perspective, the selective distribution of investment in infrastructure is an influential parameter of the final outcome, as it can generate new traffic and induce modal choice. However, since the beginning of the 1980s a road-biased redistribution of the aggregate European ITI is taking place. The share of investment in the most environment-friendly elements of the network follows a negative trend.

This is particular true in the case of Greece, where under investment and monomodal priorities characterise the national level policies. The importance of modernising both rail and maritime transport has been neglected. Even though the substantial EU financial contribution increased the level of investment in transport infrastructure, it has not managed to alter the unsustainable modal priorities. The latter has been a product of the negative institutional framework in Greece, the features of the infrastructure projects per se, and the lack of alternative EU scenarios to facilitate the objective of integrating an environmental dimension into its transport policy.

In the short term this policy pattern adversely affects the distribution of traffic volume and the competitive position of less developed transport modes. In the long term it negates the integration of transport networks and undermines the concept of sustainable mobility. The fast development of all infrastructure transport modes remains the only way to integrate them in a multimodal perspective and must be a strategic consideration of the current Common Transport Policy. Investment policies have to come to grips with these problems.

Considering that the level of goods and passenger transport is expected to grow rapidly in the foreseeable future, policymakers at a national, regional or European level must recognise in practice that railroads and waterways should progressively attract more business at the expense of congested and less environment-friendly road transport.

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Wrestling with the Octopus - New approaches to tackling traffic and sprawl

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Abstract
At both sides of the Atlantic Ocean urban sprawl is characterised by many of the same features. Governments in both Britain and the U.S.A. are tackling it with various policy instruments in the form of carrots and sticks, although the balance is open to question.

Keywords
Traffic, Urban sprawl, U.S.A., U.K.

Introduction
The twin problems of traffic congestion and urban sprawl are one of the defining features of the late 20th century. As long ago as 1928, Clough William-Ellis wrote England and the Octopus - a passionate tirade against uncontrolled roadside ribbon development which, even then, was spreading its tentacles ever further into the English countryside.

'It is this uneconomic 'ribbon development' along the main roads that is so rapidly destroying such country amenity as is still left near our growing towns and we are doing little or nothing to combat it. The disfiguring little buildings grow up and multiply like nettles along a drain, like lice upon a tape-worm.'

For William-Ellis, it was not only the direct loss of valuable farmland that was at stake, but the erosion of the cultural identity of ancient villages and the aesthetic damage to the landscape caused by garish billboards and other symbols of modern, urban development spreading through the countryside.

Today, on both sides of the Atlantic, the tide of car-dependent development continues. People are becoming locked into lifestyles which not only draw heavily on limited environmental resources (clean air, open space, tranquillity), but which are also increasingly recognised as constrained by their reliance on the car and the nature of suburban development. The isolation of the suburbs, the amount of time required for travel and the lack of community fostered in bland, generic developments are important factors acting to lessen people's quality of life.

But the continuation of these trends is not inevitable. In both Europe and America there are signs that a new approach is underway - one which will help to reduce our dependency on the car, and by doing so, to reduce the environmental impacts of transport while boosting the vitality of our villages, towns and cities. This paper examines the motivations for such change, the hurdles we face in making progress and draws on experiences in the UK and US that help to show new ways forward.

Transport and land use policy in the UK
Over the last 50 years the English countryside has experienced an enormous degree of change. New development, of a scale and type never previously experienced, has fundamentally changed the character of many rural areas and ushered in new ways of living in the countryside. Underlying these changes lies the fact that three hundred people have left England's major cities each day for the past 20 years. They have left behind urban areas where over 600,000 hectares of land lie vacant. In turn, green fields totalling as much as 11,000 ha have been urbanised every year (Sinclair, 1992).

Linked closely to these changes has been the growth in our dependence on the car as the major form of transport. Since 1970 the average annual distance British people drive has almost doubled to 10,400 kilometres. There has been a steep decline in the distance walked or cycled, with three-quarters of all journeys between two and five miles (3.2 km - 8 km) now being made by car (DoT, 1996). The experience of the UK, therefore, has been one in which the growth in affluence and car ownership has corresponded with a flight from the cities to the suburbs and beyond. The ensuing spread
of low density development has fuelled car dependency, which in turn, has fuelled traffic growth.

Two steps forward

Groups such as CPRE have highlighted the environmental consequences of these trends for many years (e.g. see Matson and Burton, 1996). It was not until recently, however, that the UK Government took steps to introduce new policies to tackle the interrelated issues of traffic and sprawl. The publication of Planning Policy Guidance note 13: Transport (PPG 13) marked an important milestone in the development of land use and transport policies in the UK. The aim of PPG 13 is explained below:

‘By planning land use and transport together in ways which enable people to carry out their everyday activities with less need to travel, local planning authorities can reduce reliance on the private car and make a significant contribution to the environmental goals set out in the Government’s Sustainable Development Strategy.’ (DoR/DoT, 1994, Paragraph 1.3).

At last, here was Government policy advocating the importance of reducing the need to travel and highlighting the necessity of making more efficient use of land resources. There is a new emphasis on locating more development in existing urban areas where a range of services are available and where people have greater opportunity to get about by public transport, bike and foot. For the first time, the role of land use planning was identified as a legitimate tool in tackling transport problems.

In addition to PPG 13, the UK Government also introduced measures as part of its climate change strategy to address the costs of road travel. The strategy includes a commitment to increase the costs of road fuel duties by at least 5% above the level of inflation each year, for an unspecified period of time. Although, many commentators (including CPRE) argue that this increase in cost will be insufficient to bring about significant changes in driving behaviour, it is acknowledged as a step in the right direction.

Steps back

The success of PPG 13 in practice inevitably relies on other aspects of transport policy too. The relative costs of road travel and the availability of alternative forms of transport are crucial adjuncts, while local government has a pivotal role in reflecting the guidance in day to day decision-making.

While positive change is underway in the UK, several ‘blockages’ to progress can be identified. These include:

- Apathy in local government - there is a perception in some areas of local government that PPG 13 is too little, too late, and that the influence of changing development patterns will be insignificant in comparison to other forces encouraging people to use their cars more often;
- limitations in local government power - can mean that local governments are less able to support land use strategies with other compatible actions - such as raising the costs of travelling by car relative to the price of public transport fares;
- local government competition - competition between local governments for economic development can override environmental considerations, such as the need to reduce parking levels or to protect greenbelt land;
- a powerful development community - which seeks to overturn restrictions on traffic-generating development and which is often unwilling to take on the perceived risks of developing in new areas (such as inner city areas);
- a lack of conviction at all levels - from the general public to national government - that we really can reduce car usage and that public transport or walking and cycling offer a viable alternative;
- the costs of change - increasing financial constraints on local authorities’ transport budgets hampers the development of alternative transport solutions.

The purpose of this report, therefore, is to explore the lessons that US transport and land use practice might offer for decision-makers and communities working to overcome these problems in the UK. Conversely, it looks at what messages US policy makers might take from the UK experience of land use and transport planning.

Transport and land use policy in the US

In the US - home of the car - it is little surprise that the trends in land use and transport in the UK described above can also readily be seen - but even more so! In most areas, suburban new development is the norm and in many states vast areas of land have been - and still are being - devoted to low density development, where the different
types of land use (e.g. employment, retail, residential) are clearly segregated and only accessible by car. In the Chicago region, for example, between 1970 and 1990 the population grew by 4%, but the urbanised area increased by a stunning 55% (Grimshaw, 1996). In the Denver area, over 36,400 ha of land are being consumed by new development each year (National Geographic, 1996), while Phoenix, Arizona grows at the rate of 10 ha each day (Newsweek, 1995).

The transport consequences of modern American sprawl development can be seen in the travel trends. Compared with British residents, Americans drive twice as far each year (20,600 km) (Benfield, 1995). This difference is explained less by the fact that Americans make longer car journeys (in fact the average US car trip is only slightly longer than the average UK car trip (Shipper et al., 1995)), and more by the fact that they make a greater number of journeys altogether (average of 11 per capita every week). As Schipper et al. state: 'the lack of walking and cycling trips in the US contrast with figures for the other countries, suggesting that Americans drive for many purposes which Europeans walk.'

As a result, the US consumes more than one third of the world's transport energy (Benfield, 1995). Environmental problems such as air pollution and the depletion of natural resources, such as drinking water and farmlands, are just some of the negative consequences of the growth in sprawl and traffic. There is also a growing recognition of the social problems that can be created by modern development and the substantial economic costs inherent in having to serve a diffuse road-based development patterns. The disillusionment with the quality of life available to many people living in the modern suburbs is an increasing source of public debate as evidenced by Newsweek's special issue (15th May, 1995) entitled 'Bye-Bye, Suburban Dream - 15 ways to fix the suburbs'.

**New policy directions**

In tackling such problems in the US, the most significant national policy developments have been the revision and strengthening of the Clean Air Act in 1990 and the introduction of the Inter-modal Surface Transportation Efficiency Act in 1991 (ISTEA). The aim of ISTEA, in particular, is:

'to develop a National Inter-modal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner.'

Together these Acts have sharply focused attention on the problem of emissions from the transportation sector. The Clean Air Act provides a powerful legislative framework to ensure that local governments take action to address air pollution problems in their areas. In turn, ISTEA provides the means to implement less polluting transport solutions through transport funding from national to local governments. In the implementation of these pieces of legislation there is a recognition of the important role land development will play, although the power of national government to influence land use is severely limited.

At state and local levels there are also a wealth of initiatives underway. Some aim to involve communities in identifying new visions for development, others involve new plans for public transport or examine the fine detail of urban design to promote more pedestrian and cycle friendly environments. As in the UK, the general focus is on promoting more traditional (denser) forms of development which are carefully designed to provide a range of services and activities within reach of each other and where public transport, walking and cycling are promoted as attractive alternatives to using the car. Above all, it is about creating 'liveable places' which offer people something more than simply an address to call their own.

**Trips - and stumbles**

While ISTEA is widely hailed as a major step forward, the reality of implementation (as with PPG 13 in the UK) has highlighted a number of problem issues. Interestingly, many of the 'blockages' to achieving more transport and energy-efficient development in the UK highlighted above, are also manifest in the US. For example,

- *inertia in local government* - State Highways Departments seem unwilling to abandon long-standing 'favourite' road building plans and much of the federal transport budget for local government continues to be spent on highway improvements and maintenance;
- *limited local government powers* - in several States (e.g., Washington) the spending of local fuel taxes is constrained
by Constitutional provisions which require that these moneys are spent for highway purposes alone, thereby ruling out their use in funding public transport alternatives;

- **local government competition** - competition between local governments is fierce to attract development which will boost property tax revenue. In the absence of a regional land use planning framework in most areas, it is extremely difficult for local authorities to risk pioneering growth management plans. In the Chicago region, for example, there are over 270 local government jurisdictions!

- **the power of the development community** - in states such as California the development community is a powerful financial and political force which can act to stall efforts aimed at managing growth. There is also a broader movement of people representing the inviolability of property rights who are active in opposing development which may limit rights to the development and use of private land (e.g. 'Property ownership was the keystone of liberty, and who was the slum landlord but that quintessential American, the property owner? Don’t tell me what to do with my land!' Kunstler, 1993, p. 36);

- **lack of conviction** - political fear of increasing the costs of travelling by car is widespread (as in Europe) and the existing low levels of public transport patronage highlight the difficulties of motivating modal shift in future;

- **the costs of change** - as in the UK, the costs of developing new transport alternatives are seen to be prohibitive. Proposals for public transport schemes often require a local ballot to approve funding through tax increases. Cities like Seattle have experienced difficulty in winning voter support for such initiatives in the past.

### Motivations for change

On both sides of the Atlantic, therefore, there appears to be a growing awareness of the damage that has been inflicted on the natural environment and our communities by the twin problems of traffic and sprawl. It is interesting to note that while the need for change may be widely recognised, the specific motivations for change differ between the UK and the US and, indeed, between different parts of the US. In the UK, for example, the motivations behind PPG 13 can primarily be seen to be the need to reduce CO₂ emissions from the transport sector. Arguments that environmentalists and others had put forward for many years about the need to conserve finite land resources from sprawl development and to protect the High Street (akin to the US ‘Main Street’) from powerful out-of-town retail, suddenly gained new political urgency in view of international agreements to stabilise CO₂ emissions.

In the US, CO₂ emissions or the loss of land resources, do not seem to have played such a pivotal role in motivating policy change. In contrast, the need to tackle air quality problems appears to have been a more powerful political ‘driver’. In addition, individual states each have their own environmental issue which resonates with the public. In Washington State (and more widely in the North West), for example, this centres around the health of the native wild salmon species in the region’s rivers. Oregonians talk of the ‘second Oregon paycheck’ - referring to the quality of the environment as an extra bonus to living there. In Colorado, the ability of residents living in the Denver region to see the Rockies unmarred by a brown cloud of pollution is seen to be a key indicator of local environmental quality.

### Lessons

Recognising the different underlying motivations for policy change is helpful in explaining the variations in policy responses that can be seen in the UK and US. Translating different policy ‘levers’ and tools from an American to British context (and vice versa) offers new opportunities to motivate change and the possibility of helping us to break through some of the ‘blockages’ described above that currently hinder more sustainable patterns of living.

The absence of a national framework for land use planning in the US limits the opportunities for introducing nationally-driven policy mechanisms such as PPG 13. In its absence, however, many different initiatives have been developed which are aimed at achieving similar goals. Some of those which seem most relevant to policy debates in the UK are discussed below.

### Growth management measures

Growth management is a politically sensitive issue in many states and this limits the opportunities for tightening land use controls or introducing urban growth boundaries. However, some states - Washington and
Oregon, in particular - have introduced Growth Management Acts and urban growth boundaries have been established around cities like Portland. Defending these mechanisms against those who would seek to weaken them is an on-going battle. With time, however, it is becoming clearer that growth management can play a crucial role in strengthening the local economy by ensuring that the quality of the environment is maintained as an asset attracting new investment. As the economies of cities like Portland and Seattle thrive, the logic of growth management becomes increasingly convincing.

*The costs of sprawl*

A key dimension to debates about sprawl in the US, is the focus on the costs inherent in such low density forms of development. A number of studies (e.g. Diamond and Noonan, 1996) have been completed or are underway which seek to quantify the total costs of sprawl development by examining the costs of installing new utility services (such as electricity, waste and water), new infrastructure (e.g. roads and schools), services (such as the fire and police), as well as some of the wider environmental costs. From this, the costs of new development can be weighed against the future benefits to local government which will be derived from the generation of new local tax revenue.

In many cases, it is estimated that new development is not paying its way and that in effect, new suburban development is being subsidised by existing urban residents and creating a heavy financial burden for the future. The seriousness of this impending fiscal crisis has brought important new players into the debate, such as the Bank of America who, together with the California Resources Agency, the Greenbelt Alliance, and the Low Income Housing Fund, produced a report which stated that:

‘unchecked sprawl has shifted from an engine of California’s growth to a force that now threatens to inhibit growth and degrade the quality of our life.’

Concluding that sprawl ‘is a luxury we can no longer afford’ this report and others provide a convincing new case for action.

*‘Smart growth’*

Linked to discussions about the cost of sprawl, is a new emphasis on the need to promote ‘smart growth’. Among others, the American Planning Association and the US Environmental Protection Agency are promoting smart growth concepts which emphasise the economic benefits of developing in a resource-efficient manner. In addition to the use of land use planning mechanisms to guide such development, a range of economic incentives are being explored which aim to promote development and lifestyle choices which are more resource-efficient and reduce car travel.

A good example of such work, is the development of the concept of the ‘location-efficient mortgage’. This initiative is based on research in Chicago, Los Angeles and San Francisco which examined the differences in household expenditure between areas which were either well-served or not by public transport and other services. It was found that in areas rich in public transport and shops, banks and other services, households spend between $350 to $390 less each month on travel. Mortgage companies are now being encouraged to take this factor into account when estimating how much they are prepared to lend. By making an extra increment of money available to buyers who are looking in transport-efficient locations, mortgage companies can increase the attractiveness of the property market in these areas and highlight the positive benefits of choosing less car-dependent lifestyles.

*Transit-orientated development and the New Urbanism*

While UK towns and cities have often planned new development in relation to public transport nodes, the implementation of transit-orientated development projects in the US offer lessons in design and detail. Transit-orientated developments (TODs) have been popularised by architects such as Peter Calthorpe and implemented in places like Portland, Los Angeles and Chicago. Using neo-traditional design principles, TODs aim to create places which include a fairly dense mixture of building types (e.g. housing, shops and businesses), promote an equally diverse mix of people and activities, and which are pedestrian friendly and closely linked by public transport services.

In some cities transit-orientated development proposals play a major role in land use and transport policies. For example, in Portland the aim is to secure a 5% reduction in traffic emissions over a 20 year period through TODs. In working towards such goals, the level of detail and consistency in implementation is important. For example, land use densities in Portland are managed to locate ‘the highest densities in the Downtown and along potential and existing transit corridors’. In addition, there
are limitations on the amount of ground level blank wall allowed on downtown buildings to create a more interesting pedestrian environment. Other work has gone on to promote walking by widening sidewalks, improving lighting and planting trees. Some of this work has even been supported by Congestion Management and Air Quality funding available under ISTEA, which more usually goes towards traditional traffic management initiatives.

Concepts of New Urbanism, promoted by architects like Peter Calthorpe, Andres Duany and Elizabeth Plater-Zyberk, have resulted in the building of a number of high quality developments across the US. These are characterised by a mix of types of building, built at fairly high densities (e.g. terrace or ‘row’ houses). Attention is given to providing attractive sidewalks, footpath links between different areas and to the development of a focal point, such as a village green. The meticulous attention to detail in many of these developments help to reinforce the positive image of TOD development and boost the wider public appeal of new styles of living.

**Taxes and tax relief**

Local governments in the US have considerable discretion in introducing taxes and tax relief initiatives designed to serve local goals. An example - once again drawn from Portland - is the provision of tax abatements lasting up to 10 years for businesses which carry out redevelopment in the city centre. Consideration is now being given to extend such abatements to investments made on properties surrounding public transport nodes.

At a national level, Low Income Housing Tax Credits have been made available. These allow businesses who diversify into the provision of affordable housing to offset these investments against their general taxes. As a result there has been a significant increase in the availability of funding for local community development corporations. In Los Angeles, use is also made of the existing sales tax to help fund public transport in the region. Here, one percent of the local sales tax is earmarked by law for the funding of the public transport network - helping to provide a sound resource base for the service.

**Community problem-solving**

The importance of developing policy actions on the basis of community involvement and consensus holds a position of high importance in the US. Different approaches to getting people involved in ‘visioning’ processes and community planning are often imaginative and exciting in comparison to more traditional methods of public participation used in the UK.

One interesting initiative is the PLACE’S project (PLAnning for Community Energy, Environmental and Economic Sustainability). PLACE’S is a computer-assisted method to promote design of sustainable communities. It uses a comprehensive set of energy-conscious urban design and growth management measures applicable in a wide range of conditions. The method consists of three elements: a modelling tool to measure the total energy and air quality impacts of different growth patterns; a methodology for sustainable urban design; and community involvement techniques. Through a series of meetings between the community, local government and the project consultants, local problems and trends are identified and future scenarios discussed. The technical information and modelling tool can be used as a basis for looking at future development scenarios, including the outcome of continuing with the business-as-usual approach, as well as the results of opting for more energy-efficient development patterns.

While such detailed local planning processes can be time consuming, the case study results to date are encouraging. In general, local communities favour energy-efficient development forms when offered the chance to analyse a range of development options. The indications are that energy-conscious development can reduce per capita energy use and pollutant emissions at the neighbourhood level by as much as 50% below conventional business-as-usual designs.

**English lessons - too many carrots, not enough sticks**

Many of the approaches described above are fresh to UK land use and transport practice and offer exciting opportunities for change. In turn, however, there are lessons that the UK may have to offer the US. Perhaps the most significant of these, is the importance of the relative costs of different transport modes in influencing transport choices.

There is an understandable unwillingness in the US to address directly the costs of driving, either by raising fuel taxes or through parking controls, congestion charging and other fiscal mechanisms. Rather, the focus for tackling traffic and
sprawl seems to be more about creating places where a mix of services and transport options are available to reduce people's need to use a car. It is, of course, easy to understand why politicians and others are wary of action to raise the costs of car use. But the experience of the UK suggests that land use planning and public transport alone will not stem the tide of traffic growth or people's desire to use the car. As Susan Owens put it, 'planning can change morphology but not motivation'.

Over the last 20 years, the UK has seen a steady rise in the length of average journey and in the proportion of journeys made by car. At the same time, the real costs of public transport fares have increased faster than the growth in incomes, while the real costs of motoring have fallen. Driving is therefore more affordable now than it was 20 years ago and despite recent increases in fuel duty, public transport is still relatively much more expensive.

Some of the travel trends discussed in this paper can be explained by the growth in low density, car-dependent development and the decline in public transport. But it also has to be recognised, that the choices people make when moving to low-density locations which depend on car access, are influenced by the cost of driving to and from such destinations. In short, tackling the 'octopus' of urban sprawl and traffic growth will require governments at all levels, and on both sides of the Atlantic to embrace not only the need for new land use policies and better public transport, but also the relative costs of people's travel choices.

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When is a car NOT a car?

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Abstract
Co-operative Auto Network, as the name suggests, is a car sharing operation in Vancouver, Canada. Most members have dispensed with a car and use the co-op to provide them with private mobility as and when they need it.

Keywords
Car sharing, Canada, Co-operatives

Introduction

Premise A: The rapid increase in car numbers and vehicular kilometres travelled with their social, economic and environmental costs are heavily taxing our communities, cities and planet.

Premise B: Many people recognise Premise A but persist in owning a car because of those times when they really need one. These are times when cost, access, convenience and time considerations make any other option undesirable or impossible.

Premise C: When people persist in owning a car, they will use it - and will either use it to the exclusion of alternatives or at least far more than the availability and utility of alternatives would require.

Therefore: If we supply people with what they need in a system which will mitigate against frivolous use and abuse, the individual will be satisfied and the community will be spared the social, economic and environmental costs.

With car sharing we recognise the need to drive while we work to eliminate dependence. Car sharing provides a low cost ‘carrot’ for people to access cars, while providing a self-modulated ‘stick’ to eliminate auto-dependency. This is the operating principle of the Co-operative Auto Network - or CAN.

Co-operative Auto Network: the rationale

The truth of the loosely-formed syllogism above is not much more than common sense. The alternatives don’t do the whole job and once money has been invested to purchase a vehicle the buyer will tend to feel compelled to use it. People will use a car or the alternatives - rarely both. Furthermore, there is a suggestion that it is cheaper to drive. The economics of auto ownership as it now stands reinforces the separation of car costs into two realms: the cost of owning and the cost of using. This means after financing the sticker price, buying insurance, tyres, and parking, plus paying any maintenance bills, the owner dissociates these expenses and thinks getting to the hockey game will cost only the gas to get there and parking if he can’t find a free spot. This construct is entirely false but once the car is ‘paid for’ it often seems to people that driving isn’t as costly as taking the bus - and they do the trip in half the time. So using the car for every transport need becomes the economically-reinforced norm, rather than the mode of last resort.

With car sharing through CAN, we answer the need for the occasional use of a car while we restate the psycho-economic relationship of car use. We have reversed the economic argument. CAN makes it cheap to ‘purchase’ a nice-looking car which is convenient and maintenance-free. Then we make every kilometre driven and every hour used have a cost. This works to limit vehicular kilometres travelled and completely eliminate many trips. The Co-operative Auto Network opens the door to practical alternatives to the car’s overuse and encourages its members to walk or cycle, and take the bus or a taxi more.
Car Sharing - The background

The first car sharing organisations were founded in Germany and Switzerland a decade ago. Present estimates put the number of car shares in Europe at around 100,000 members in 300 cities. Car sharing is already making in-roads in North America. AutoCom and CommunAuto have formed in Quebec, Canada; while the Co-operative Auto Network (CAN) in Vancouver, British Columbia, introduced its service in January 1997. About the same time the Victoria Car Share Co-op launched their service. As of yet, there is no operation in the United States of America, however, various organisations have been studying the European and Canadian models to start service in Oregon, Washington, California and Colorado. A new service is also about to launch in Singapore, while Japanese and Korean researchers are putting together their own projects.

Elemental to the car sharing concept is the understanding that many people would like to get rid of their car and walk, cycle, or take transit more, but persist in owning a vehicle for those occasional times when using a car is really the only alternative. It doesn’t take much of a stretch to say that if they have a car, they’re going to use it - perhaps more frequently than is really necessary. Getting one’s money’s worth from the investment typically means driving is the most economical option for getting around.

Or at least so it seems. Cars make a pretty large dent in the budget of most people who own one. Changing the nature of how we view the expenses incurred by driving will begin to help change the reliance we have on automobiles.

Changing this viewpoint of a vehicle as an article one must have, to the understanding that it is mobility which is needed, is key to car sharing. The idea isn’t such a radically new one either. Car sharing, in principle, has been going on in families and between friends for as long as there have been cars. As a co-operatively incorporated entity though, it started in the German neighbourhood of Kreuzberg in 1968. Brothers Markus and Carsten Petersen, along with a few friends, got together to share the ‘guilt’ and expense of car ownership. Their incorporation took place after over two years of research and tests. They called themselves StadtAuto (which translates as Instead of Cars) but sounds like StadtAuto (translation: City Car). Both translations well describe the best use and intent of the organisation.

By December of 1990, StadtAuto was accepting at least one new member a day. The following two years saw the membership go from 500 to 1000 people, while across Europe as many as 300 cities have started co-ops of their own. In the summer of 1994, there were 3000 car-sharers in Germany alone. Most recent figures put the number of car sharers at 100,000 across Europe. The many co-ops and clubs are now linked by European Car Sharing, an organisation funded by the European Union that allows for car share cross usage throughout the various cities. For example, a member in Berlin, Germany can travel by train to Lucerne, Switzerland and use a car there.

Travelling by bus or train from city to city demonstrates a strong commitment to car sharing. It tends to work best in dense urban centres with a well-established transportation infrastructure where access to shops and services is near at hand. This is because working with the established transportation links - from trains to taxi cabs - is not just beneficial to car sharing - it is mandatory. In those areas, car sharing is able to foster the notion that members can commit to walk, roller blade, cycle, take transit, or taxi cab, before choosing to reserve a vehicle for short term obligations. For longer trips, trains, car pools and rental companies are perfectly situated in the network to meet the needs of members. Car sharing is then seen as a ‘missing link’ in a transportation chain.

The concept is not completely new to North America. In 1993, the Province of Quebec sponsored the development of the successful and highly regarded co-operative AutoCom in Quebec City. A sister organisation in Montréal, CommunAuto Inc. is proving to be just as valuable. The early results of these organisations are very promising and are showing every indication of the success enjoyed by their European counterparts. Meanwhile, both Vancouver and Victoria can boast of budding car sharing organisations. Both organisations run under not-for-profit status are receiving a great deal of support and attention. They look to be well on their way to the overwhelming successes of the preceding models.
The Need for Car Sharing

In Vancouver we continue to experience rapid growth, as is the case in most urbanised areas around the world. This growth is both in terms of numbers of people moving into a given region and in per capita automobile ownership and usage as well. It is putting a serious strain on our environment, communities and personal finances. Yet, while the transit system is adequate for most of our mobility needs, access to a privately-owned automobile remains a necessity for many people. Car sharing, however, offers a great opportunity to change the way people perceive vehicle access and expense while reducing the reliance we have on car ownership. It can meet the needs of the individual who requires occasional use of an automobile without the inconvenience and high costs associated with ownership. Car sharing pragmatically recognises the benefits of the car while seeking to open the doors to practical alternatives to its overuse.

Interest in the concept, and its practical application is really taking off - for many good reasons. Sustainability has been the catchword of policy-making ever since Grö Brundtland submitted her Commission's report Our Common Future to the United Nations in 1987. Words like social, economic and environmental have now been cemented to development, just as the three-legged stool of sustainability has become the model for many initiatives. The primary findings of all the conferences, workshops and reports since then has been that the individual has to make the right choices in his or her day-to-day life in order for sustainability to be a reality. This is easy to say but not as easy to do. For our social, economic, and environmental (global) objectives to be met, a lot of hard choices have to be made by people who are reluctant to change, aren't sold on the necessity to change and aren't being offered many options to make the difficult changes any easier.

Most people have grown accustomed to a certain lifestyle. Making choices which may limit personal freedoms for more time-consuming alternatives is not going to inspire the radical personal adjustments so needed. Meanwhile, the most damaging element to our ozone, aired health and society right now is the same element that most people believe they cannot do without - the automobile. With car sharing, they can 'do without' - without losing the access and mobility they need. The option becomes clear; pay less without making huge changes in your life. The individual can potentially save a lot of money by walking a couple of blocks to the car share car, or a little farther to the corner store; while improving air quality, reducing stress on green space and eliminating some non-point sources of pollution.

Car sharing also creates social benefits for the members. Co-op members will re-connect with others in their community and feel pride in taking action to improve the environment. But, saving time and money aren't the sole social goals of car sharing. It is also about equity, empowerment and opening access to the fiscally challenged in our community. Sustainability isn't just about how we can continue in our present path of development while decreasing our destructive impact on the environment. A marked requirement of an improved environment is providing one that is equitable; where everyone has a fair share of the resources available. People of a low income will have the access to a vehicle which has denied them the mobility to get to job interviews and maintain close contact with friends and family.

Joining a car share co-op won't just assuage people's need to act, it will have positive effects on their bank accounts. The average cost of owning and operating a vehicle for 18,000 kilometres in the Lower Mainland is estimated at $8029.75 CND yearly (Canadian Automotive Association, 1997). The same source calculates a typical mid-sized automobile will cost 49.8 cents for every kilometre driven and that's only if the car is driven for 18,000 kilometres each year. If the vehicle is driven less, the cost per kilometre increases. In the economics of car ownership, it pays to drive more! This is due to the substantial up-front costs of financing, insuring a car and the depreciation that occurs as soon as you drive off the lot. One pretty much has to drive over 18,000 kilometres in one year to make the purchase break even and drive more to make it worthwhile.

But driving more and farther is not an option. Already, transportation is directly responsible for almost fifty percent of greenhouse gas emissions in British Columbia. In the last five years this kind of pollution has increased by 23 percent or if said another way, since 1990 car and trucks in this province are spewing an extra 1,553
million tonnes of particulates into the air we breathe every year. As the percentile growth in vehicles to the Lower Mainland continues to surpass population growth dependence on them grows. Conversely, it is the steady rise in vehicular kilometres travelled, which is overtaxing our airshed. People are living farther and farther away from where they work and opting to drive the span in between more and more. Scenarios like that has the US Environmental Agency forecasting that all of the air quality improvements based on cleaner gasoline and more fuel efficient vehicles will be out-striped by sheer increase in use by the turn of the century.

Conversely, many other vehicles spend most of their productive life parked. This means the resource is inefficiently used and the pollution generated while the vehicle was being manufactured was almost completely for nought. It is estimated that if every person holding a driver’s license in the Pacific Northwest - from Vancouver down to the tip of Oregon - were to go and get into a car and drive right now, over 1,000,000 cars would still be parked (Drumming, 1996).

Shared cars are used more intensively to utilise the full potential of the resource, rather than remain parked for long periods causing congestion in our neighbourhoods. Increased usage and wear and tear on the vehicle will not reduce its reliability as it will be well maintained to ensure a high degree of energy-efficiency. With one car on the street instead of ten, it is easy to say many non-point sources of pollution will be eliminated. Furthermore, the air quality implications of car sharing are huge. Using better maintained cars, while replacing the older vehicles driven for their fiscal sense rather than air sense can have a huge impact on our airshed.

We have pointed to the various assets of car sharing. It is the type of organisation that will put walking, cycling and transit before car use while raising awareness of the transport issues that are encroaching on our well-being, quality of life and ability to live in an environmentally, socially, and economically less stressful way. It will lead to people structuring their lives closer to home, with less economic leakage from their community. Ultimately, car sharing is about options and choice. The option to go where you need to go when you need to get there and being able to choose to get around in a way that reflects your economic realities and environmental sensibilities - and you will even meet your neighbour while you do it.

**Car sharing process - an overview**

**Joining the co-op - requirements and procedures**

Joining the co-operative is as simple as producing a valid BC driver’s license. The co-operative may do credit and driver’s record checks as well. An agreement specifying the details of responsibilities and entitlements of the members should be signed by each member. They will have to buy a member share in the co-operative. Typically this is about $500 and is refundable if membership ceases. It is beneficial to have new members commit to a minimum six month period.

**Car use and billing**

The cars have a designated parking area, serving members within a five minute walking distance of their homes. When the car is needed, the member makes a reservation by phone, specifying when the car is needed and for how long. The member then goes to the car and picks up the key from a small lock box on or by the car and before driving away, checks the last logged kilometre entry against the odometer. At the end of the trip, the car is returned to its reserved parking, the journal is completed with the new odometer reading, and the car key is returned to the lock box. Once a month, a bill will arrive clearly stating times of usage as well as kilometres driven. The monthly bill is calculated according to a formula based on these two factors, plus a monthly administration fee.

**Car location and the reservation process**

Cars are placed throughout the community depending on the location of members in that area. As the membership grows, the ratio will increase to at least ten members for each car. Reservation of the cars is made on a first-come-first-serve basis. In the case the nearest vehicle is reserved, the second nearest is checked for availability, then the third nearest, and so on. Occasionally renting a car when demand for co-op cars exceeds supply may be necessary. A relationship with a rental agency would also work well in situations where renting a car is the more economical option for the member.

**Cleaning, routine maintenance and repair**

One important aspect of the co-op is to
ensure that all vehicles are in good running condition, especially to keep emissions as low as possible. Every 5000 kilometres the cars are taken in for independent inspection but a regular schedule of tasks is vital to the operation. These duties would include, collection of log books, routine cleaning, filling of fluids, AirCare inspections, and minor repairs.

**Insurance and Liability**
The cars are insured as is customary for corporations owning a fleet of vehicles. The package consists of a fleet insurance for the vehicles, with packages similar to the insurance for privately-owned vehicles but differing rates. In addition, an umbrella insurance is in place to cover liabilities not covered by the standard car insurance. Any member who damages a vehicle may be responsible for the insurance deductible as well as any expenses not covered by the insurer.

**Conclusion**
Car Sharing in urban areas has tremendous potential to reduce congestion, increase cycling, walking and transit use, reduce air pollution, and improve health and fitness. It offers greater mobility by providing a choice of vehicle of different size and type to those who are mobility poor, and through reducing congestion bestows greater accessibility to everyone whose communities are severed by fear of road danger. It encourages people to shop, work, rest and play in their locality, thus contributing immensely to community consolidation. In addition, it gives far better value for money than owning a car.

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Car Sharing: Breaking out of the Transportation Trap

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Abstract
The history and present status of the car sharing mobility service is reviewed, with emphasis on developments in Western Europe and North America. Car sharing is viewed as an effective response to the rising costs and increasingly serious transportation problems created by private automobile transport. We note briefly evidence on the mobility behaviour of members of car sharing organisations and conclude by describing the promising future of a mobility service devoted to the concept of sharing cars.

Keywords
Car sharing, Mobility.

Introduction
The Pacific Northwest section of the United States has a long tradition of land use planning. Nonetheless, the automobile has taken over our landscape, much as it has everywhere else in this country. Our open countryside is cluttered with highways and urban sprawl. The downtown sections of our major cities are dominated by cars, roadways and garages. Portland has serious air quality pollution alerts during the summer. Seattle is ranked in the top ten most heavily congested cities in the nation.

During the past decade, those of us who live and work here have been inundated with information urging us to take the bus, walk, ride a bike, or carpool, instead of driving our car to work alone. In spite of all this publicity, far more of us drive to work alone today than in the 1980s. Census Bureau data, for example, indicate that 65% of the workers who live in Portland drove to work alone in 1990, compared to 55.9% in 1980. Carpooling declined from 16.5% to 12.9%, while mass transit use decreased from 15.9% to 10.9%.
These trends are discouraging. Unfortunately, much the same has occurred in most metropolitan areas of the country. They indicate we are making very little headway in solving the many problems which the automobile, in spite of all its delights, has brought to our communities.

The Problems
These problems cannot be taken lightly. Automobile usage is responsible for up to 60% of the air pollution in the United States, as well as pervasive noise pollution in most urban communities. Automobiles are a major source of carbon dioxide, the so called ‘greenhouse gas’ which is thought to be the major contributor to global warming. The automobile has drastically reshaped our urban environment, with between 25% and 30% of urban land devoted to roads, parking spaces and other automobile facilities.

Long congestion delays, especially at commuting times, are estimated to cost the United States each year 1.2 billion hours of lost time, 2.2 billion gallons of gasoline and $30 billion in lost productivity. The automobile consumes enormous amounts of natural resources including the materials (steel, rubber, zinc) used in its construction, the petroleum required to fuel it and the materials used to build and maintain the highway and roadway system in this country.

Personal Costs
And then there are the very steep costs involved in owning and operating a car. Each year the American Automobile Association (AAA) publishes a brochure which describes the national averages for various types of vehicles. Their analysis covers three models (Ford Escort, Ford Taurus and Chevrolet Caprice) equipped with standard and optional accessories, fuel costs (based on $1.20 a gallon for 1996), and ownership costs, including insurance, finance charges, license, and normal depreciation costs.

Depending on the number of miles the car is driven per year, the (AAA) analysis (Your
Driving Costs - 1996 AAA, Heathrow, Florida) indicates it can cost anywhere from $4,380 to $8,440 to own and operate these relatively inexpensive vehicles. Of course many people spend quite a bit more. With this information you can see that your out-of-pocket costs for making a 10-mile trip to the video store add a hidden cost of $4-$5 to the rental of the video itself. It is rare that we take this cost into consideration in deciding whether or not to make such a trip.

Social Costs
Finally, we cannot ignore the enormous external costs (externality) involved in maintaining the transportation system in this country. These externalities are usually hidden because drivers are never directly charged for them. The cost of gasoline and vehicle registration do not cover the full costs of roadway construction and maintenance. They pay but a small fraction of the costs of highway patrols, traffic management, and parking enforcement. The same is true for the heavy costs involved in trying to reduce air pollution or treat the substantial effects it has on human health. All of these hidden costs make driving seem much cheaper than it actually is and only further encourage the needless use of automobiles.

Each of these problems will continue to worsen, unless we can overcome our reluctance to change the way we use our automobiles. Is there anything we can do to change these 'deeply ingrained' driving habits of millions of Americans? What alternatives are available to individuals who want to break their dependence on the private automobile?

The Car Sharing Concept
These questions continue to stimulate a good deal of thinking about reducing automobile usage. Car sharing is one of the most innovative of new approaches. Car sharing in Europe, especially in Switzerland and Germany, has become increasingly popular. A car sharing organisation consists of a group of individuals who share a fleet of cars in much the same way that members of a farm share expensive agricultural equipment, or a group who own a time-share divide the use of a resort property. Unlike auto rental, car sharing vehicles are located close to where the members live, typically within 3 blocks of their residence.

Car sharing differs from ride-sharing or carpooling in that it is not designed to transport a group of individuals to a common destination at the same time. Instead, it provides access to a vehicle when walking, cycling or public transit is not possible. A variety of vehicle types are available in the fleet to give members an efficient way to meet infrequent needs, e.g., hauling, moving, transporting large groups. Car sharing differs from conventional car rental agencies in that it gives individuals access to a car for a short term period. Members are not charged for more than the time they actually use the car.

How They Work
When you would like to use a car, whether for an hour or a day, you simply telephone a reservation number and schedule your use. Reservations can be made 24 hours a day, seven days a week. When your reservation is confirmed, you walk a short distance to pick up the car. The vehicle is usually parked at one of the permanent sites located throughout various neighbourhoods of the city. These sites are reserved solely for the vehicles owned by the car sharing organisation. Most of the bookings can be made at nearby locations. When this is not possible, other locations in the neighbourhood can be utilised.

At each of the neighbourhood locations in Switzerland, there is a safe containing the car keys, accessible with your own special key and computerised card. When you have completed your trip, you fill out a log-book, recording the distance and duration of your journey. At the end of each month, you receive a bill based on the mileage and time entries for that period. It is important to note that all maintenance, service, and repairs are handled by the car sharing organisation. The same is true for full insurance coverage, as well as the cost of gasoline. Your only obligation is to fill the tank, if its below one quarter full, making payment with the company credit card.

Becoming a Member
Joining a car sharing organisation usually requires a fixed membership fee which is fully refundable should you decide to leave. Some also have a modest non-refundable annual fee. After that, you only pay for your driving. The fee scale is based on the duration of your trip and the distance travelled. Some organisations also offer members various package plans which depend on their frequency of usage. Table 1 (below) illustrates two such plans.
The membership fee is fully refundable in both communities. In Quebec City there are three fare schedules. They vary in terms of anticipated usage of the service, with fees slightly higher during the peak weekend demand period. Package A, designed for members who frequently need a car, is shown above. All fees are US currency values.

<table>
<thead>
<tr>
<th>Membership Fee</th>
<th>Monthly Fee</th>
<th>Cost/km</th>
<th>Rate/hr (Tues - Thurs)</th>
<th>Rate/hr (Fri - Mon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancouver, BC</td>
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<td>7</td>
<td>18 cents</td>
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<td>Quebec City</td>
<td>$365</td>
<td>21</td>
<td>10 cents</td>
<td>$0.88</td>
</tr>
</tbody>
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### Cost Comparisons

How does the cost of car sharing compare with other forms of travel? Imagine you wanted to use a car for two hours to run some errands during the week. Under the current fee schedule in Quebec City, with taxes, insurance and gas included, such a trip would cost $4.38. The same trip would cost $47.92 with a conventional car rental, $1.10 by bus and $16.65 by taxi. Thus, car sharing is more expensive than the bus but less than a taxi or car rental. This is also true for longer trips, including a two day weekend trip, where using a taxi is out of the question.

It is all but impossible to make single trip cost comparisons with a privately owned car. But in general, based on evidence collected over the years in Switzerland, car sharing makes sense for everyone except those who wish or need to drive to work every day. Economically speaking, car sharing is considered to be less expensive than owning a car for individuals who drive less than about 10,000 miles a year. Up to this value, owning a car, including a second car, is more expensive than belonging to a car sharing organisation.

### The European Scene

While car sharing has in principle operated among friends and family members since the onset of the automobile, the first formal car sharing organisation, known as Auto Teilet Genossenschaft (ATG) was established in Switzerland in 1987 and today, as Car Sharing Switzerland, is the worlds largest car sharing organisation. Its membership has grown steadily from 280 in 1990 to 2500 in 1994 and now, with the merger of two other car sharing organisations, it serves over 16,000 users. These individuals share about 600 cars located at 350 stations in 280 cities and towns throughout Switzerland.

Germany’s car sharing movement began about a year later with the formation of StattAuto (Instead of car) in Berlin. After a slow start StattAuto incorporated in 1990 and has become increasingly popular. In 1992 the group grew from 500 to 1000 members and by 1996 StattAuto’s membership had grown to more than 3000 members and a fleet of over 200 vehicles. Unlike Switzerland, which has a single integrated system, independent car sharing groups have been organised in over 30 other German cities. For example, the group in Hamburg which started in 1991 with 2 cars for 20 individuals now has 63 cars for 1100 members.

### Car Sharing in North America

At the present time there are four car sharing organisations in North America, all in Canada. Auto-Com in Quebec City and CommunAuto in Montreal have become quite successful. The Quebec car sharing organisation now has almost 200 members and 18 cars, while there are nearly 50 members and 6 cars in the Montreal group. The third group, Cooperative Auto Network (CAN), has just started operating in Vancouver, British Columbia, after over a year of detailed planning. They currently have 21 members, with more on the wait list, and three cars. Finally, the Victoria Car Share Co-op in nearby Victoria, British Columbia with 22 members and 3 cars is currently planning an expansion program for 150 additional members who will be sharing 12 new vehicles.

While car sharing projects are also on the drawing boards in Portland and other cities in the Northwest, there are currently no fully operational car sharing organisations in the United States. Short-Term Auto Rental (STAR) was an ambitious car sharing organisation which was formed in San Francisco in 1985. At one point there were over 240 participating households and 53 cars in STAR, which were centrally located in an underground garage within a cluster of high rise apartment houses. Unfortunately, as a result of unprofitable operations and poor management, STAR folded after 18 months of what had been planned as a 3-year project.

### Member Profile
Car sharing is clearly not for everyone. But for individuals who do not own a car or would like to cut back to one or indeed, get rid of their cars all together, car sharing offers an attractive alternative. For these people car sharing would enable them to meet their short term, occasional transportation needs far less expensively than a taxi or rental service, and more conveniently than public transit. It would also give them access to a much greater range of vehicles, e.g. pick-up, minivan, utility vehicle, than owning a single car.

Recent research has indicated that car sharing appeals to a much wider range of individuals than most had anticipated. The information gathered from a survey of AutoCom and CommunAuto members revealed that:

- 47% of the members were men and 53% women
- The average age of members was 38
- Almost 40% of the members were professionals in health-care or education
- Approximately 20% were white-collar workers in business, research or administration
- Fewer than 9% were students and even fewer were blue-collar workers
- After joining, 75% of the members sold a previously owned car

Benefits

Car sharing is a promising approach to the serious transportation problems which confront most major metropolitan communities today. Recent research in Europe indicates that individuals who belong to a car sharing organisation tend to drive less, use public transportation more often, and save money by doing so. Switzerland’s Department of Energy and Germany’s Department of Transportation have investigated the effects of Auto Toilet membership on mobility habits and energy usage. Instead of driving 10,000-15,000 kilometres per year as previous car owners, ATG users drove only 5000 km per year, and used public transportation for their remaining transportation needs.

Annual mobility expenses were reduced by $2,000. In addition, taking advantage of ATG has reduced the use of energy by almost 50% for motorised mobility. It has been estimated that the average owner of a driver’s license in Switzerland and Germany completes 80% of his trips in his own car.

Almost the opposite was true for typical ATG users, who used public transportation for 75% of their transportation needs. In this way, car sharing translates into fewer cars on the road and, thereby, a reduction in both traffic congestion and air pollution. As a result, car sharing helps individuals to come to grips with the rising financial and environmental costs of automobile driving described at the outset.

The Mobility Perspective

Members of car sharing groups do not focus on using the car for transportation, but rather on mobility as a whole. In contrast to car companies, a car sharing organisation does not sell cars, but individual trips and services: trips in a commuter car for individuals, trips in a caravan or van for the entire family, trips in a minibus if you take along your sports team, or trips in a pickup truck if you help a friend move - the right car for every occasion, as opposed to owning a car that does not match every specific need.

In other words, people are encouraged to choose the best possible vehicle or combination of vehicles among the train, bicycle, shared taxi, and car for their specific mobility need. In Europe and Canada this perspective has promoted the development of co-operative agreements between car sharing and other transportation organisations.

Members of car sharing groups are given discounts on transit passes and lower rates for taxi rides and car rentals.

The Future

Despite the overwhelming popularity of single-occupancy vehicle travel, there has never been a better time to initiate a car sharing organisation like ATG in the US. Public transportation systems continue to improve and would benefit even further by collaborating with car sharing organisations. In addition, the costs of driving, maintaining and insuring private automobiles are steadily rising. Increasing traffic congestion and air pollution have also led many individuals to search for alternative approaches to mobility. By reducing both the number of cars and a person’s dependency on them, car sharing can make a very large contribution to this objective.
Alternative Fuels, Alternative Drive Lines - The Route to Improvements?

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Abstract
Given the negative effects of increased Carbon dioxide emissions (and a limited fuel supply) it is necessary to develop alternative fuels for use in passenger transport. In the short term, however, increased fuel efficiency is more achievable and much more important. In addition, it is vital that commuter transport strategies are developed and implemented.

Keywords
Alternative fuelled vehicles, fuel efficiency, global warming

Introduction
Passenger transport in all industrialised countries is highly dependent on automobiles. Although both congestion and local air pollution supports the environmentalists' urgent plea for a more sustainable transport system in general, the private passenger car is expected to continue its leading role for the next decades. In order to reduce environmental burdens and adverse health effects, emissions standards have been implemented in nearly all countries. The U.S.A. and Japan have driven the technological development of Low Emission Vehicles. Further progress has led to Ultra Low Emission Vehicle (ULEV) technology. The state of California has promoted the introduction of Zero Emission Vehicles (ZEV) - which at the moment means electric vehicles - within the next decade.

The global threat of climate change, mainly due to the emission of Carbon dioxide, confronts car manufacturers with an additional challenge. Consumption of fossil fuels has to be reduced significantly within the upcoming decades. International climate policy demands reducing emission rates by 50 - 80% by the middle of the next century. There are two alternatives: either the energy demand of the car is to be reduced, or the energy supply has to be shifted towards low carbon and carbon-free fuels. Because fuel alternatives are expected to be more costly than contemporary fuels, a reduction of the cars' energy demand can be seen as a necessity for a general shift towards fuels with less specific greenhouse gas emissions.

Except for the future ZEV requirements in California, all automobile concepts are based upon gasoline and diesel engines. Alternative fuels like Methanol, Ethanol and Natural Gas are used in some market niches, but there are practical, as well as economic obstacles against a general shift towards these fuels. The use of electric cars is restricted by the limited battery capacity and its excessive weight. New developments have not yet demonstrated their durability and cost effectiveness. Fuel cell technology has jumped forward during the last decade but it is questionable whether it will be ready for the market before 2020.

The basic concepts of the gasoline and the diesel engine are more than a hundred years old, but there are still major potentials for better fuel efficiency. Together with continued progress in lowering vehicle weight, tyre friction and air drag, there may be a potential for a fivefold increase in fuel efficiency. This can be realised within about a decade, and it would enable the consumer to drive a passenger car using less than 2 litres per 100 kilometres. More important, this in return would also result in a fivefold reduction in CO₂ emissions.

Cars and the Environment
The growth of the number of automobiles in all industrialised countries has caused severe environmental damage as well as air pollution and noise burdens to citizens. Although exhaust emission and noise standards for automobiles were already introduced during the 1970s and have been significantly tightened since then, technical improvements achieved at the individual level have been upset by the overall
increasing number of cars.

With the introduction of stringent emission standards for passenger cars in the European Union (E.U.) that are more or less comparable to the U.S. provisions, and with the latest decisions regarding future exhaust emission limits, the E.U. has expressed its desire to mobilise all existing technological developments for cleaner vehicles.

Despite these facts the European activities have failed to reach substantive progress towards "sustainable mobility". One of the most urgent problems is the continuing growth in energy demand and increasing Carbon dioxide emissions from the transport sector.

Nevertheless, extended regulatory measures do not promise to solve the great problems linked with automobile use in our countries. Taking a look at the U.S.A. shows that technical progress in the field of exhaust emissions is not enough to attain even the National Ambient Air Quality Standards (NAAQS) and is neither able to comply with the climate policy goals due to the growth of the vehicle fleet and vehicle miles-travelled. Europe faces a similar situation: most scenarios foresee an even greater increase both in the number of passenger cars and in the share of commercial vehicles (trucks and vans) in the goods transport market. Public transportation as well as rail freight transport has lost market shares and is still doing so. All over Europe that will lead to more air pollution, more noise and more fuel consumption.

Motorised vehicles contribute about 20 - 25% of worldwide CO₂ emissions, most of which is produced by the rich and highly industrialised countries. It is their responsibility - our responsibility - to stabilise and to reduce these emissions in order to keep the climate balanced. On the other hand, the developing countries face an urgent demand for more motorised transportation. Without the rich countries reducing their energy consumption drastically (especially for oil and coal), there is no chance for any worldwide sustainable development.

Despite all concerns about the problem of explosive population growth in developing countries, greenhouse gas emissions in industrialised countries are still growing. If we look at the contributors to the average annual CO₂ increase in the transport sector of about 19 million tonnes, less than 50% of this increase (8.7 million tonnes) is produced by non-OECD countries, i.e. 85% of the world's population. Not only is the wealth gap between rich and poor countries still growing, but also the absolute and relative contribution of the rich countries to environmental problems and waste of resources is increasing as well. Within these problems, transport is the fastest growing sector.

Options for the Future

In this situation, environmental and transportation policy has three options for the future.

First, standards for energy consumption, exhaust emissions and noise must be tightened to a level that allows achievement of all necessary environmental goals. This will demand techniques that are mainly state of the art today, supplemented by new technologies (like brake energy recovery units), which are expected to be developed within the next decade. We have to keep in mind that ambitious standards deserve a lead time of 5 - 10 years for research and development; if we want the industry to reach for the automobile of the future, the target must be fixed now. In the long run, energy use in transport must be completely based on renewable energy and "zero emission" vehicles. Furthermore, traffic safety must be much better in the future than today.

Second, the traffic system as a whole has to undergo changes in terms of more efficiency and environmental sustainability. This means that different transportation modes not only have to be optimised in themselves, but their respective shares in total transport have to be optimised according to the specific advantages of each mode. This will lead to a reduction of passenger car transport especially in large cities and conurbations by means of more and better mass transportation systems, and the shift of long distance road transport to rail. Due to the advantages of these alternatives, not only the environment, but also traffic safety would improve significantly.

Third, structural changes that occurred during the last decades in urban development and in industry have to be revised in terms of less transport needs. Obviously, the industrialised countries' system of organising their social and economic lives cannot serve as a model for the whole world. Spending so much energy and natural resources on transportation (as well as on other energy usages) cannot be implemented in developing countries. If we
want to serve their development and their markets as well, more sustainable structures have to be created in rich countries first.

These options are widely discussed and accepted in general but there are only a few real answers on how to manage them in detail. Despite the huge problems the industry is facing with the development of technical solutions regarding vehicles, the first issue (technical improvements) seems to be the least problematic - compared to the latter two.

This paper does not discuss the status of development of different technical solutions and options - this should be left to the engineers in the industry who know the details better. The environment adapted automobile of the future will face numerous problems which engineers must solve, if given enough encouragement, time and priority. If development stops at a certain hurdle and misses further reductions in emissions and energy consumption, restructuring of transport towards low energy systems must be pushed even more to compensate for this. Failing in this challenge will result in higher pressure to revise the transport intensive structures of our society and economy.

In order to come to a more precise view of what the term “future” might comprise I would like to suggest to choose the years 2005 and 2050 like Germany’s Parliamentary Commission on “Preventive Measures to Protect the Earth’s Atmosphere” has done recently. The year 2005 stands for a rather near future: a renewed vehicle fleet at that time demands introduction of redesigned cars starting within a few years from now. Political and economic decisions that provide the basis for the industry’s planning in construction and development of cars have to be made now.

The year 2050 seems quite far away, but it is a rather short time to have effective policy strategies implemented. This year may be used as a synonym for the time when we will have to “complete the ecological circle”: having reached the status of real zero emissions (not just shifting the problems out of a certain region, like California does) and completely renewable energy supplies.

**Perspectives for Improved Energy Efficiency**

Fighting the greenhouse effect requires a 50% reduction in CO₂ emissions by 2020 and an 80% reduction by 2050. Is there a realistic approach to achieve these goals with vehicle and engine technology that basically has been familiar to us for more than 100 years? What kind of alternative fuels or energy alternatives will be at hand to solve the problem?

**The Clean and Fuel Efficient Car of Tomorrow**

Today’s automobiles cover a wide range of transportation purposes: most times of the year there is only one person driving to and from work, to a shopping place or elsewhere. The car is used for very short periods each day (about 45 to 50 minutes in German cities and conurbations on average) at speeds below 50 km/h, occasionally up to 80 or 100 km/h on highways.

It is obvious that today’s cars are not constructed and optimised for this. They are able to carry 5 passengers with voluminous luggage at speeds up to 200 km/h or even more (35% of the passenger cars currently sold in Germany reach a top speed above 180 km/h). Their engines often deliver unnecessary high maximum power for the main transportation purposes. The average engine displacement, the size and the weight of the cars is increased nearly every year. Each new model replacing the previous is faster, bigger, more powerful and also heavier. Thus, it is drifting further away from what is actually needed.

The car designed to meet the real challenges of our traffic and environmental situation is not yet on the market: it should offer room for 4 passengers, have a 20 kW engine that goes up to 80 or 100 km/h, ultra low emissions and ultra low noise. It features all the equipment necessary to transport the passengers safely at these low speeds and lets the driver act responsibly towards non-motorised traffic participants (cruise control for speed limits of 30 or 50 km/h within settlements). Even for somewhat larger models for the family weekend the fuel efficiency should be better than 3 litres per 100 km.

To set the engineering goals and to prepare the markets for this car demands governmental guidance. Standards for emissions, noise and fuel consumption have to be tightened by introducing a long term schedule. But not only traditional regulatory initiatives are needed. In addition to technical regulations, other measures geared towards reforming traffic and tax policies are needed to foster the “Car for the Future”. Rising energy prices (i.e. taxes), strict speed limits and restrictions on the use of automobiles in inner city and residential
areas should augment the new practice.

If there were solutions at hand for extending the familiar car use in highly industrialised countries over the next decades by reaching the environmental and energy goals set above - why not? But from today's point of view they can be fulfilled neither with large cars nor with the amount of car use (i.e. annual mileage) that has become common, and is predicted to grow even further.

The future automobile, therefore, has to be smaller and one, and would cover most of the transportation purposes that occur in industrialised countries today. This car is not an additional "City Car". It is meant to substitute the common car. In addition, there has to be much less individual car mileage than today.

**Alternative Fuels and Drivetrains**

Can new "alternative" fuels or energy sources solve the dilemma? Will they offer a technical solution to all our problems?

Since the oil crisis of the early 1970s, numerous projects have been funded to develop "alternative" fuels. They were expected to provide independence from OPEC. Nowadays, the ranking of attributes linked to those fuels has changed. In the U.S.A. it is not the danger of oil shortages that drives the present R & D activities but the hope for lower exhaust emissions.

Organisations and governments engaged in the field of CO₂ emission reduction look at alternative fuels for this purpose, too. Two principal groups of fuels are reviewed: gasoline substitutes and diesel replacements.

**Gasoline substitutes** - Alcohols are produced from natural gas or from various biomass. Because alcohols carry Oxygen within their chemical structure, combustion is more efficient than with gasoline and produces less Hydrocarbon and Carbon monoxide emissions. This is the main reason behind the discussion currently underway in the United States.

Specific CO₂ emissions of Methanol derived from natural gas are not expected to be better than from gasoline or diesel fuel; Methanol produced from coal forms even more CO₂ because of its production process.

Ethanol can be produced from nearly all plants. According to the specific needs of the plants, energy has to be calculated for cultivation, harvest and chemical processing to account for the net CO₂ benefit. Under the condition that the energy input comes from biomass itself the energy benefit would be about 10 - 20% for plants such as sugar beet, potatoes, wheat or corn (maize). The ecological aspects of large scale production of biomass should be considered carefully. Brazil's Ethanol program has brought up serious problems in that field.

**Diesel replacements** - In Germany, in particular, rapeseed oil has been proposed for use in diesel engines. Although some research has been carried out by successfully burning non-modified rapeseed oil in diesel engines, it has not been entirely successful because the valves and pistons are not sufficiently robust to the harshness of the fuel. Chemical processing of rapeseed oil forming Methyl Ester would solve this problem but requires further energy input. Balancing energy input and output for cultivation (including fertilisers and herbicides), harvest and processing, a net CO₂ benefit of about 20 - 25% compared to diesel fuel is expected. Regulated emissions are expected to be comparable to those produced by the use of diesel fuel. But there are serious objections to this options because of the N₂O emissions which have a high highly negative environmental impact. In Europe, only a small share of the diesel market could be replaced, and this alternative is very costly.

Liquid fuels like alcohols and rapeseed oil are preferred as replacements for gasoline or diesel fuel because of their simple storage. Gaseous fuels, either Compressed or Liquefied Natural Gas (CNG, LNG) and LPG (Liquefied Petroleum Gas) can be used in conventional combustion engines as well, but need special costly storage equipment. Energy input, especially for compressing or liquefying natural gas, worsens the energy and CO₂ balance. Nevertheless, the use of these fuels is going to bring some CO₂ benefits because of the lower specific Carbon content of gas compared to mineral oil-based fuel. In addition, regulated exhaust emissions of catalyst-equipped automobiles burning gaseous fuels are lower than from gasoline engines.

The production costs of biomass fuels is higher than fossil fuels. If these were preferable for environmental reasons - which needs careful research because of several ecological problems related to industrialised agriculture and large scale processing - switching to them on the basis of today's fuel prices would demand huge funding. On the other hand, prices could be competitive if crude oil prices were doubled.

At present, saving fuel by using better engines and "downsizing" are more cost effective than alternative fuel options.
In California, the market introduction of electrically powered automobiles (EV) seems within reach following governmental regulations. From the environmental viewpoint, EVs provide local air pollution benefits while emitting at the power plants. EVs driven with electricity produced by coal fired power plants tend to have higher regulated specific emissions, depending on their desulphurisation or denitrification equipment. In any case, more CO₂ is emitted compared to gasoline automobiles. Real global CO₂ benefits by use of EVs would be reached if electricity was produced in decentralised combined heat and power plants based on natural gas or, of course, with energy from renewable sources like water, wind or solar energy.

The restrictions given by its limited energy storage capacity preserve the use of EVs to daily trip lengths up to about 100 km. Driving an EV is currently very costly because of the limited durability of the battery: depending on its technology, after about 600 to 1000 loading cycles a new battery set must be bought. Further development, however, may reduce the cost. Market penetration of EVs designed for short trip length, especially in conurbations, is expected to increase to 20%.

The Vision: Sustainable Mobility

Breaking the continuing motorisation trend in passenger and goods transport in industrialised countries seems an utopian effort regarding the economic and social developments that has led to the present situation. Individual lifestyles, rising incomes and more spare time encourage the continued growth of the passenger car market. Road haulage is more competitive than rail transport in the growing market segment of costly goods and serves the consumers’ and the producers’ demand for immediate delivery of products and parts, respectively.

In countries with an already high level of motorisation, female drivers keep the passenger car market running, either by adding a second and third car per household or by using a car as regularly as it has become common for men of all ages. In the future, older people will have become accustomed to individual car use and are expected to continue this habit. It is not just for trips to and from work that the automobile fleet continues to grow but for other purposes, such as leisure and shopping. Therefore, solutions primarily aimed at commuters, such as car sharing or mass transportation, will have only limited success (nevertheless, expanding these services is urgently needed in most cities and conurbations).

There is a general demand not only for real clean cars but for an environmentally friendly traffic system. Mass transportation systems provide advantages in energy consumption, emissions, traffic safety and numerous other fields. With today’s communication technology, better services and more comfortable travel organisations, it is possible to make mass transportation systems more attractive. In a changing world with rising energy prices, automobile use will be restricted to areas and trip purposes where it provides its unique advantages.

Freight

Switching transport from road to rail demands considerable investment and organisational changes on the local, regional, national and European scale. There is a lack of European co-operation in the rail sector. There is hope that, with private operators engaged in this market, integration and improvement of services will happen.

Producing for greater markets and larger production units has led to increasing transport in the last few decades. This will continue if transportation costs remain at low levels thus externalising ecological and social costs. Fair pricing will be the most efficient way to initiate transport avoidance in the production and distribution chain of goods. Following the oil price crisis of the early 1970’s, the industry conjured up many energy saving developments to alleviate higher transportation costs. Similarly, increasing taxes now will encourage greater efficiencies, improved fuel economy and a reduction in demand for transport.

Conclusion

Alternative fuels and alternative drive trains will contribute to the long term challenge of “Sustainable Transportation” but this is only one direction to move. Reducing the energy demand of the transport system by technical means as well as by transport mode shifts is seen as a necessary strategy to meet environmental and social needs.

The most important challenge that goes beyond the responsibility of technicians and transportation scientists is a reduction of the demand for motorised transport in our societies. Creating more societal wealth with less transportation should be a realistic policy goal for the upcoming decades.
Changing industry behaviour: the role of prices and regulations

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Abstract
The role of the price mechanism in changing and controlling behaviour is becoming increasingly popular, most particularly in the field of transport. This article uses data from transport managers to argue that the power of the price mechanism is limited and that legislation and regulation are required to shift product from road to alternative modes.

Keywords
Price mechanism, legislation, regulation, modal shift.

Introduction
"... sometimes the incredible journeys that product takes, for example we transport seat fabric for General Motors to make car seats. The actual fabric comes from Nottingham, we ship it down to Tarragona in Spain and from Tarragona we go back to Germany where it is fitted in the car, the car then goes back to the U.K. and is sold. It's actually cheaper to do that. Also Adidas up in Manchester, the product is made in north Wales, that is, parts of the trainer are made up in north Wales, it is then shipped out to Czechoslovakia, a process takes place in Czechoslovakia, it then runs from Czechoslovakia to Lisbon where the product is finished and assembled in cottage industry in Lisbon and then shipped back to Manchester. Now the reason that is happening is because transport is comparatively cheap compared to production costs." (Logistics director)

This quote from a senior manager in a large freight forwarding company demonstrates the inefficient outcomes which can arise from an economic system where price signals are disguised or distorted. Under such a situation, most especially when transport prices do not reflect social and environmental as well as economic costs, it

Table 1: Europe 15 Freight Transport

<table>
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<tr>
<th>Year</th>
<th>1970</th>
<th>1980</th>
<th>1990</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>49%</td>
<td>57%</td>
<td>67%</td>
<td>71%</td>
</tr>
<tr>
<td>Rail</td>
<td>32%</td>
<td>25%</td>
<td>19%</td>
<td>15%</td>
</tr>
<tr>
<td>Waterways</td>
<td>12%</td>
<td>10%</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Pipelines</td>
<td>7%</td>
<td>8%</td>
<td>6%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: European Commission (1995a)

This pattern of growth, both in terms of the volume of freight (European Commission, 1997) and of percentage travelling by road (Economist Intelligence Unit, 1996) is forecast to continue. Such a situation requires a number of policy responses, specifically maximising locally sourced production and encouraging a shift to more efficient modes of transport. The focus in this article is on the second of these, where policy makers can choose between a particular combination of regulatory and fiscal tools to influence behaviour. The emphasis at a supra national level is increasingly being placed on fiscal measures.
with the Commission publishing a Green Paper entitled “Towards fair and Efficient pricing in transport” (European Commission, 1995b). The Commission write:

“This Green Paper looks at pricing. Transport policies have in the past focused largely on direct regulation. Whilst rules have brought significant improvements in some areas, they have not been able to unlock the full potential of response options that can be triggered through price signals. Price based policies give citizens and businesses incentives to find solutions to problems.” (European Commission, 1995b: i).

I would argue that while the price mechanism influences behaviour there is still an important role for direct regulations.

The data below are drawn from a European Union funded project (DGVII - European Marine Motorways) investigating the feasibility of shifting freight from road to maritime transport. During this project thirty transport and logistics specialists were contacted, twenty were interviewed face to face and the remainder over the phone or via the fax. The responses relevant to the policy debate relate to questions on what interviewees thought would happen in the field of transport policy over the next five to ten years and what they saw as the disadvantages of road as a mode of transport. In total fifteen respondents articulated a view on these issues.

Perceptions of the future

The perceptions of what would happen in the future fell into three main categories:

• that prices would or should be used to control change;
• that the technical specifications of vehicles should be improved; or
• that regulations to curb road use will be introduced.

Comments on the role of the price mechanism included:

“It makes sense to move freight away from the congestion and put it on some other mode ... But there’s going to have to be an incentive for people to do that and just now I don’t think that’s actually there to be honest.” (Distribution manager).

“I think the bottom line for us would be cost. If a cheaper option were available to us and we could maintain the current level of criteria in terms of transit times and what have you, then we would seriously consider moving.” (Logistics Manager).

“The market will dictate what it wants and the manufacturers will have to service that. Somebody will have to provide us with some benefits, cost reductions, some rebates and say, look if you’re moving by rail, you pay less taxes.” (Export operations manager).

These quotes demonstrate that some industrialists believe that fiscal measures should be used in the future to influence modal choice. Perhaps not surprisingly, however, these interviewees see the price mechanism being used as a reward for change. Under this view a shift of modes is to be encouraged not by internalising external costs but by providing cheaper transport through subsidies or cut taxes.

Another response was the recognition of a connection between moving freight by road and pollution but a belief that this could be overcome (or minimised) by technical changes. Responses included:

“... all of our equipment we use is new equipment. So that all the vehicles we use have catalytic converters and it’s all brand new kit so as far as we can be we are trying to be kind to the environment. We don’t run around in 6 year old vehicles that spew out a black cloud everywhere you go. So as far as [the environment] is concerned the part we play is by keeping our equipment well serviced, well maintained and up to the European specification.” (Regional manger).

“In many ways we are committed to an environmental policy. I mean our trucks went through a programme where we had this project on ways of looking at all these things that will benefit the environment right from skirts on the side of the vans which reduce the actual cost of fuel to the amount of fuel we use and to fitting asbestos free brakes. Also we have automatic maintenance greasing and oiling on the big double decker’s and we have things that stop the trucks freezing up in the winter so that you don’t pollute the roadside with any trucks when the weather is bad.” (Operations manager).

“... we are very environmentally friendly and we are taking active steps to ensure our vehicles are clean and green.” (Operations manager).

What emerges from this data is the way in which “environmental” is interpreted. There is no question of reducing the number of vehicles on the road, either through localised production and distribution centres or using alternative modes, rather the emphasis is on
simply making the present (and growing) number of vehicles more "clean and green". While this is, of course, welcome, it demonstrates the different levels on which one can claim to be "environmental" and the need to negotiate a tougher interpretation. This was recognised by some respondents, who argued that prescriptive measures would be required to cut the number of trucks on the road:

"I think, right, there's been a lot of talk around the industry about various changes and what have you and I don't think, honestly, that anything has been said recently that would make us change. I mean there's been a lot of talk and a lot of hype in the past and literally nothing has come of it. To be honest with you, I dare say there will come a time when obviously a change will happen but at this moment in time there is nothing making us as a manufacturer seriously think about changing our mode of transport ... I don't see anything at this point in time forcing us to change, until something happens in that respect I don't see us deciding to change." (Logistics manager).

"The push to globalisation I think at the moment is fuelling the spread of further supplies and the only thing that I would see arresting that advance to globalisation is restriction on movements, whether that would be by toll or whether it be practical restriction as the French have done by saying no trucks on a Saturday and Sunday, Germany are actually looking at the very same thing, everybody (in the industry) has complained at what has happened in France, so perhaps it's not such a bad idea after all." (Logistics director).

What emerges here is that relying on voluntary change from industry is likely to prove unsuccessful, and that change is going to have to be "forced" through. Both respondents cited above argue that government action will have to be taken - either to increase prices or introduce new regulations. The second respondent, however, notes the success of the new French regulations (in Easter of this year the French government prohibited the movement of goods vehicles over 7.5 tonnes at weekends and bank holidays) in altering attitudes. The apparent strength of direct regulation in changing transport behaviour emerged even more powerfully in comments relating to the perceived disadvantages of roads, and it is to these that we now turn.

**Disadvantages of road**

The most common response, from thirteen out of fifteen respondents, was to complain about regulations. Examples include:

"...if there is a bank holiday as there is in Germany today we would not be able to transit Germany from midnight last night or 10 o'clock till midnight after the bank holiday - you would need to park up. I think Luxembourg has just introduced something that you can't even park up on the highway during their closing down - in Italy every time the annual holidays start you can't travel on the roads. Going to France you can't take hazardous goods, on the Friday night drivers coming back by France have to go and park somewhere and can't move through France whereas previously if they were coming home, they could come straight through. So it is restrictions." (Operations manager)

"... in certain countries in Europe you have driving bans at the weekend. For example in France it used to be that if a driver was driving through France at the weekend and he was going home to the UK he could drive, but if he was going to a destination he couldn't - that's Saturday and it comes into force about 10 o'clock on a Saturday till about 10 o'clock Sunday evening. But now they are completely banned from driving at weekends, even if the drivers are coming home, so if they are coming home they have to stop for the weekend." (Regional manager).

"The disadvantages are obvious disadvantages, one around the weekends and the public holidays in Europe - you've got the driving restrictions - especially through France, Italy and Spain." (General manager).

"The only restrictions we have by road is the disputes that occur like the ones that we've had in France, erm and restricted driving times over the weekend period." (Assistant managing director).

"Disadvantages are driving restrictions and holidays." (Export operations manager).

"This thing with France [new regulations] is starting to make a difference, midday Saturday till 10 p.m. Sunday night commercial vehicle traffic is banned in France." (Operations manager).

What really affects behaviour, therefore, is not the varying pricing structures in terms of tolls or fines in each country, or even individual technical and mechanical specifications, but simple, direct restrictions.
If demand for a product is price inelastic (quantity demanded falls proportionately less than a price increase) then the product will still move. But if legislation is introduced banning transport via a particular route then either a local supplier will be sourced or the present supplier will have to find an alternative mode. That this was already encouraging a change of mode was evident from the comments of one respondent who is increasingly using rail to move product throughout Europe:

"The reason which has now become more pressing in recent months are the increasing restrictions of road movement through France, weekend, bank holidays, the new restrictions from 23 March which now prohibit all movements at weekends. There used to be an opportunity for trailers to move over a weekend through France if the driver is returning to his home base, so every transport company in Europe would take advantage of that and make absolutely certain that drivers based in the north of France were found to be in the south of France on a Saturday, because then they can drive home. Similarly all the Spanish hauliers make sure they are in England on a Friday because they can run back over the weekend and be back in Barcelona on Monday morning. That has all been done away with from 23 March this year and a blanket covering both Saturdays and Sunday. There really now is only one way to do it and that's by train which is not restricted and that train runs on a Sunday, no problem." (Logistics director).

Quite clearly, in this instance it was regulation which motivated change, with restrictions on movements by road at weekends forcing product movement onto an alternative mode.

**Conclusion**

In summary, the data from these industrialists demonstrates that while they recognise the power of prices their perceptions and behaviour are also strongly influenced by non-market mechanisms. Policy makers, therefore, if they are serious about changing patterns of production and distribution, should complement the power of the price mechanism with non-negotiable regulatory controls.

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