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**environmentally
sustainable transport**

ISSUES PAPER

For the workshop on

**Leisure Travel, Tourism Travel,
and the Environment**

Berlin, Germany
4-5 November, 2004

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1. INTRODUCTION

This paper has been prepared in connection with an OECD workshop on *Leisure Travel, Tourism Travel, and the Environment* to be held in Berlin under the auspices of the German Environment Agency (Umweltbundesamt: UBA) on November 4-5, 2004. **The goals of the workshop are these:**

- To raise awareness of the environmental and other impacts of leisure travel and tourism travel.
- To clarify trends in these kinds of travel and their particular environmental impacts, throughout OECD Member countries.
- To add to understanding of the factors contributing to the trends and how they might be modified.
- To present options and good practices for less transport-intensive leisure and tourism activities and for other mitigation of environmental impacts in ways that are consistent with maximising net social economic welfare.

The present paper has been prepared to set the scene for the workshop discussions and to facilitate the discussions. It does the following:

- Addresses some definitional challenges posed by ‘leisure travel’ (shorter-distance travel with no stay-over) and ‘tourism travel’ (longer-distance, longer-stay, domestic and international travel).
- Touches on what is known about trends in these types of travel in OECD countries in relation to other types of travel.
- Notes economic, social, and other factors relevant to leisure travel and tourism travel.
- Briefly reviews the environmental impacts of these types of travel and how they might be mitigated.
- Poses questions at the end of each section—except this section—for possible discussion at the workshop, brought together in Section 10.

Among the few detailed considerations of leisure travel and tourism travel has been the round table on the topic of ‘Travel and Leisure’ held by the European Conference of Ministers of Transport in 1998.^{1†} That round table primarily concerned transport aspects of leisure and tourism in western Europe. It concluded that these types of travel comprise “a poorly understood and underestimated phenomenon”. A recent paper prepared for the OECD’s Programme on Sustainable Consumption noted that tourism travel is the largest source of energy use and greenhouse gas emissions from the tourism sector.² It concluded,

Tourism-related travel represents a relatively important source of transport energy use and CO₂ emissions, although certainly not as large as other forms of travel. The environmental impacts range from moderate, concerning climate change, to locally acute, concerning more classic vehicle pollutants. However, projected growth in tourism-related travel—especially longer distance travel by air—will only increase the importance of this form of travel from an environmental policy stand-point.”

[†] Superscript numbers refer to end notes beginning on Page 19 that contain details of sources and other material.

It is time to revisit these important aspects of transport activity for all OECD countries, and focus more on the environmental impacts of leisure travel and tourism travel. The present paper broadens the consideration of leisure travel and tourism travel to North America, noting points of similarity with and differences from European travel. Available resources precluded consideration of OECD Pacific and other countries.

2. DEFINING TERMS: LEISURE TRAVEL

The term ‘leisure travel’ has no formal definition. Sometimes it is taken to be synonymous with ‘tourism travel’, discussed in the next section.³ Sometimes it is taken to embrace any travel—including tourism travel—that is not related to earning a living or otherwise providing for the essentials of life.⁴ Sometimes it excludes longer-distance travel but includes other travel that is not related to earning a living or otherwise providing for the essentials of life.⁵

One challenge in defining local leisure travel is the extent to which it should embrace travel for purposes that some perceive as discretionary and pleasurable and others perceive as necessary and even distasteful. Shopping may be the most vexing example but there are others. For many people, shopping is a leisure activity, a way to pass free time.⁶ For others it is a tiresome chore required to provide the essentials of life.

The workshop could make a strong contribution towards clarifying the concept of ‘leisure travel’. For the moment, leisure travel will be taken to mean travel that involves round a trip of less than about 160 kilometres, does not involve an overnight stay, and is unrelated to earning a living or otherwise providing for the essentials of life.

Questions: Is the definition of leisure travel proposed here useful? Is ‘leisure travel’ the best term for local, discretionary travel? How should the case of shopping as a leisure activity be handled?

3. DEFINING TERMS: TOURISM TRAVEL

An indication of the significance of tourism may be the recent transformation of the World Tourism Organization (WTO) into a specialised agency of the United Nations. In marking the new status of the WTO, UN Secretary-General Kofi Annan, wrote that “The WTO’s activities, such as the ‘Sustainable Tourism—Eliminating Poverty’ programme, will contribute to strengthening collaboration within the United Nations system to promote socially, economically, and ecologically sustainable tourism, aimed at alleviating poverty and bringing jobs to people in developing countries”.⁷

WTO defines tourism as “the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business, and other purposes not related to the exercise of an activity remunerated from within the place visited”.⁸ WTO adds these words of explanation:

Tourism is different from travel. In order for tourism to happen, there must be a displacement: an individual has to travel, using any type of means of transportation (he

might even travel on foot: nowadays, it is often the case for poorer societies, and happens even in more developed ones, and concerns pilgrims, hikers ...). But all travel is not tourism. ... the previous limits, where tourism was restricted to recreation and visiting family and friends are now expanded to include a vast array of purposes ... Tourism displacement can be with or without an overnight stay.⁹

The satellite tourism accounts developed by the World Tourism Organisation (WTO) and agreed by the United Nations Statistical Commission in 2000 provide for distinctions between inbound, domestic and outbound tourism. However, the data collected by the WTO focus on international tourist travel.¹⁰ Such a focus is inappropriate for a country such as the United States, where most travel by persons “outside their usual environment ... [for] purposes not related to the exercise of an activity remunerated from within the place visited” is to another place within the United States.

For example, if a trip to a place more than 80 kilometres from home is considered to be a trip outside of a person’s usual environment, only two per cent of such trips by U.S. residents are to destinations outside the U.S.¹¹ More than 60 per cent of such trips are within the same state (remembering that U.S. states can be quite large: Texas alone, for example, is about the size of Germany, Italy, and Switzerland combined).

The U.S. data illustrate another problem with the WTO definition. The definition can embrace just about all trips to a place more than 80 kilometres distant because few may be “related to the exercise of an activity remunerated from within the place visited”. Of the four substantive categories of such trips in the longer-distance trip file of the *2001 National Household Travel Survey*,¹² only ‘commuting’ (13 per cent of the total) would clearly not qualify. ‘Pleasure’ (56 per cent) clearly qualifies, as does ‘personal business (13 per cent)’. The latter is described as “medical visits, shopping trips, and trips to attend weddings, funerals, etc.”. Most trips described as being for ‘business’ (16 per cent) would also qualify as tourism according to the WTO definition. They mostly comprise attending conferences and meetings in connection with activities not remunerated from within the place visited.

To be more useful for transport purposes, greater precision may be required. On the face of it, the concern is with longer-distance travel involving an overnight stay for purposes other than generating income or maintaining essential functions.¹³

As with leisure travel, the workshop could make a contribution towards further clarifying the concept of ‘tourism travel’. For the moment, tourism travel will be taken to mean travel that involves a round trip of more than about 160 kilometres, involves at least one night away from home, and is unrelated to earning a living or otherwise providing for the essentials of life.

Questions. Is the definition of tourism travel proposed here useful? If not, what would be a more satisfactory definition?

4. TRENDS IN LEISURE TRAVEL

Leisure travel as defined here—less than 160 kilometres round trip, no overnight stay, purpose unrelated to earning a living or otherwise providing for the essentials of life—**is a more important transport element than tourism travel.** This is illustrated in Figure 1,¹⁴ which shows that for residents of Germany in 1994 leisure travel as defined was responsible for about 200 times as many trips as tourism travel and almost six times as many person-kilometres of travel. Note that for the data in Figure 1 a tourism (holiday) trip was one that lasted more than four days, and a leisure trip four days or less. However, leisure trips were likely to have been local because their average length was similar to that of trips to and from work.¹⁵ Thus, most leisure trips represented in Figure 1 may have conformed to the definition proposed here.

Figure 2 shows comparable data for the United States for 2001, presented to correspond to the trip purposes in Figure 1.¹⁶ Note, however, that the ‘leisure’ category in Figure 1 likely comprises what Figure 2 are ‘leisure’ trips and ‘personal business’ trips. Note too that Figure 2 has a category ‘other long-distance’ trips that is not in Figure 1. It includes all one-way trips longer than 80 kilometres that were not commuting or tourism. This category likely includes many trips that in Figure 1 would be included as ‘work-related’ trips.

Figure 1 and Figure 2 indicate that leisure trips—and personal business trips—comprise a significant category of travel. Tourism travel, by contrast, is almost insignificant as a component of all trips, although it features more strongly as a component of all travel (i.e., person-kilometres). Figure 2 suggests, in the U.S. at least, that most long-distance trips have other purposes than tourism.

The relatively greater importance of leisure trips in comparison with tourism trips could mean that in a consideration of both leisure travel and tourism travel the former should be accorded more attention. However, there are several offsetting reasons. One is the amorphous nature of leisure travel, compared with what may be more clearly definable tourism travel. Another is that there is more concern to have good information about tourism travel and to understand it because of its apparently greater economic importance. Yet another reason is that tourism

Figure 1. Trips and person-kilometres by trip purpose, Germany 1994

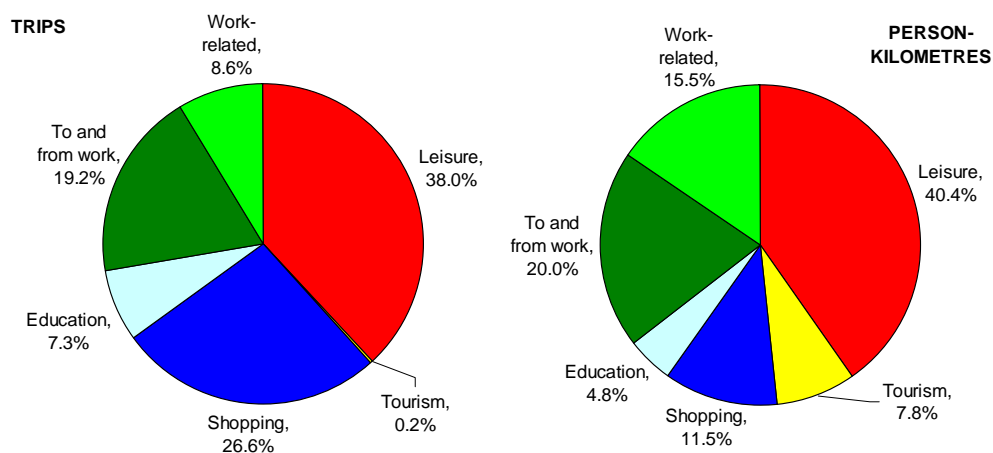
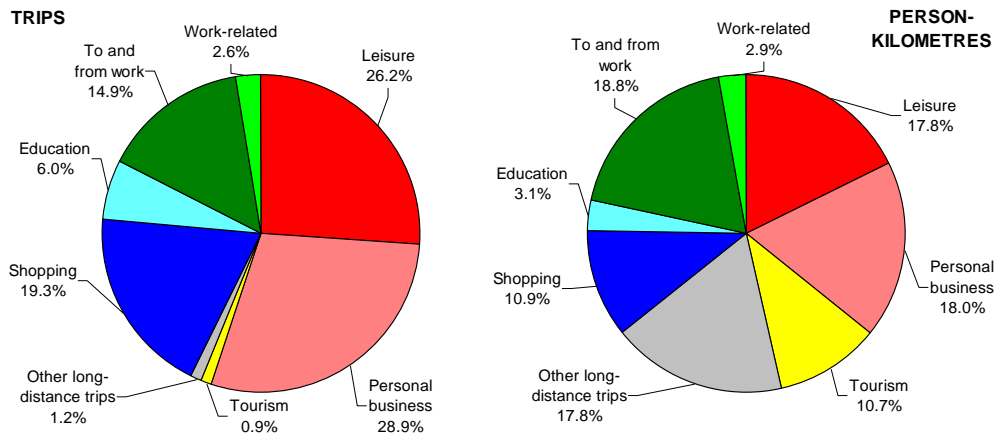


Figure 2. Trips and person-kilometres by trip purpose, U.S.A. 2001



travel may have a disproportionately strong adverse environmental impact. These matters are returned to below during the discussion of tourism travel.

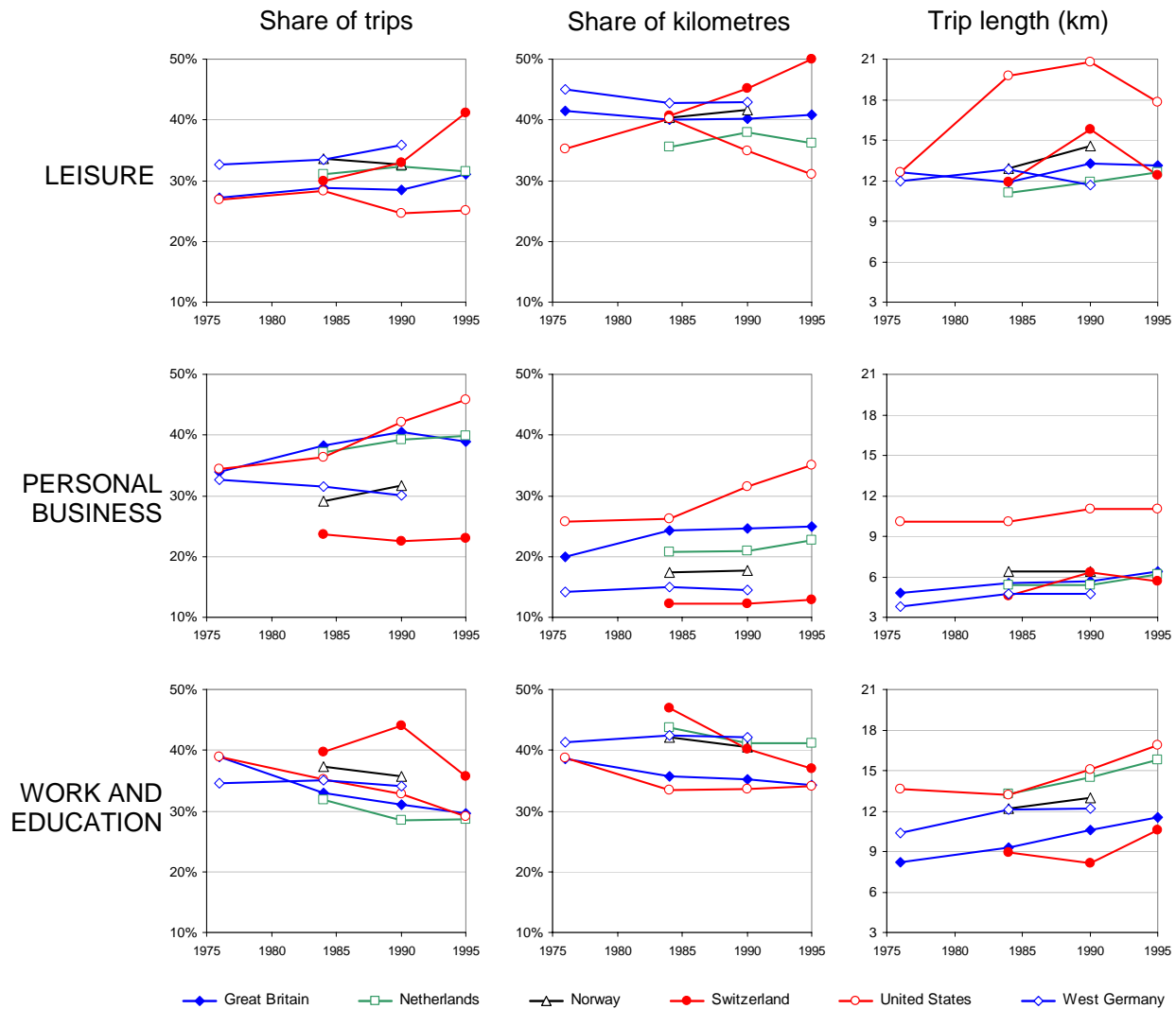
The final point to be made about Figure 1 and Figure 2 is that they suggest that journeys to and from work and for educational purposes are a relatively small part of all travel: about a quarter of both trips and person-kilometres in Germany and less in the United States. In both countries, there was more travel for leisure/personal business purposes, even more if some shopping is included as leisure/personal business.¹⁷ Nevertheless, trips to and from work and school are given much more attention in transport research and planning. In part this is because they occur with high temporal intensity and thus place special demands on transport infrastructure. Also, because most of them occur during a few hours of the week—the weekday morning and afternoon peak periods—they can give rise to high concentrations of atmospheric pollutants and result in economic costs from congestion. However, to the extent that environmental damage may be the result of overall transport activity, as for emissions of greenhouse gases, the relatively less well understood travel for leisure or personal business may have considerably greater impact.

Figure 3 on the next page shows trend data on local trips for several countries.¹⁸ Perhaps the only clear trends concern trips for work and for education (commuting trips). Their share of all trips made has tended to decline, although their share of kilometres performed has not declined to the same degree because trip distances increased.

The data in Figure 3 confirm the conclusion drawn from the data in Figure 1 and Figure 2 that the majority of shorter-distance trips made are not commuting trips but trips classified as ‘leisure’ or ‘personal business’ trips. Note that leisure trips represented in Figure 3 tended to be longer than personal business trips, although of similar length to commuting trips.¹⁹

A significant feature of trips for work and education is that they are more likely to be made by public transport, while other trips are more likely to be made by car. This is illustrated in Table 1 on Page 9,²⁰ which shows relevant weekday data for London, UK (all residents) and Toronto, Canada (residents aged over 10 years only). On these days, substantially

Figure 3. Data on shares of local trips and local distances travelled, by trip purpose



more ‘other trips’—i.e., not work- or education-related—are likely to be made by car than by public transport.

There are few data on weekend local travel. Data for the United States, where weekend travel is regularly surveyed, indicate that Saturday trip-making is at the weekday average, and that Sunday trip-making is only 11 per cent below the weekday average. A significant difference between work-related and other trips is that the former involve cars with much lower occupancies: cars being used for work-related purposes carried an average of 1.2 persons, whereas cars being used for personal business carried 1.8 persons and cars being used for social and recreational purposes carried 2.1 persons. On average, cars moving at weekends contain a third more people than cars moving during the week.²¹

Car occupancies in Europe appear to be generally lower than those in the U.S.²² Nevertheless, to the extent conclusions from the above data can be generalised, the following may be true. There are more local trips by car at weekends, because there is more leisure travel. However,

because cars are more fully occupied for leisure travel, there may be fewer vehicle movements during weekends than during the week.

Table 1. Features of motorised weekday travel in 2001 in London (UK) and Toronto (Canada)

	London, UK (all residents)	Toronto (>10 years only)
Millions of persons	7.3	4.3
Millions of trips	19.6	10.6
Commuting trips as % of trips	53%	46%
Of commuting trips, % by car	50%	64%
Of other trips, % by car	63%	90%

A final point to be made about leisure travel, however defined, is that it is particularly sensitive to price. It tends to have a higher price elasticity of demand than other types of local travel, i.e., travel price increases are more likely to result in reductions in leisure travel activity than in other types of travel activity, and vice versa. Long run elasticities of leisure travel are even higher, often exceeding 1.0, meaning that a particular increase in travel costs would result in a proportionately higher reduction in travel activity.²³

Overall conclusions concerning (local) leisure travel in OECD Europe and North America are these:

- Leisure travel is a more important element of total travel than travel to and from work or school and than tourism travel.
- Leisure travel is growing, whereas travel to and from work or school is declining
- Leisure travel is much more likely to be by car, when compared with travel to and from work or school, and thus may have proportionately stronger environmental impacts.
- Leisure travel is more sensitive to price than other travel, it is likely to increase sharply if prices fall and decrease sharply if prices rise.

Questions: What would be the best categorisation of local travel that would facilitate analysis of leisure travel as defined here? What other data on leisure travel are available that would enhance understanding of this significant element of all travel?

5. TRENDS IN TOURISM TRAVEL

International tourism statistics are complicated by the incomplete coverage mentioned above whereby there is a focus on international travel that—in the United States at least—fails to capture the largest part of travel that might reasonably qualify as tourism travel.

Moreover, there are few publicly available databases that allow ready assessment for countries or regions of recent trends in longer-distance travel by purpose and destination. Thus, **it is difficult to analyze many aspects of longer-distance travel.**

Approaching the question through tourism expenditures could be fruitful. However, available analyses do not provide a sufficient focus on *travel* expenditures to allow useful statements to be made about trends in tourism travel.²⁴

Table 2. Modes of longer-distance trips, EU15 and U.S., 2001-2002

Mode	EU15		U.S.			
	Trips/ person	Share of trips	Trips/ person	Share of trips	Distance/ trip (km)	Share of distances
Car	1.7	65%	8.2	89%	524	56%
Air	0.2	6%	0.7	7%	4,641	41%
Bus	0.3	12%	0.2	2%	787	2%
Train	0.4	14%	0.1	1%	804	1%
Totals:	2.7	97%	9.1	100%		100%

Note: EU15 longer-distance trips are all two-way trips, for any purpose, of more than 200 kilometres. Other modes (e.g., ship, motorcycle) are not represented; hence the total of shares is less than 100%. U.S. longer-distance trips are all two-way trips, for any purpose, of more than 160 kilometres.

What we do know is that during the 1990s worldwide expenditures on international tourism and tourism travel grew in real terms at about 3.4 per cent annually. International tourist arrivals grew more rapidly, at an average annual rate of about 5.3 per cent.²⁵ According to the World Tourism Organization, international tourist arrivals are expected to just about triple over the period 1995-2020, from 565 million in 1995 to 1,560 million in 2020, an overall annual growth rate of 4.1 per cent.²⁶

The long-trip dataset of the *2001 National Household Travel Survey* provided a snapshot of longer-distance travel by U.S. residents in 2001-2002, i.e., round trips longer than 160 kilometres.²⁷ On average, each U.S. resident made 9.1 such trips a year. As noted above, only two per cent of the trips were to destinations outside the U.S. (although these trips comprised 16 per cent of the person-kilometres travelled in such trips). Of all these round trips, 13 per cent were commuting trips, 16 per cent were business trips, and 13 per cent were trips for personal business. The remaining 56 per cent of longer-distance trips were ‘pleasure’ trips, which included “vacations, sightseeing excursions, as well as trips taken for the purposes of rest and relaxation, visiting friends and family or outdoor recreations”.

Table 2 shows that almost all of the longer-distance trips were made by car. The shares for personal business and pleasure trips were close to the breakdown for all longer-distance trips. When the shares of total distance travelled are estimated—as in the right-hand column of the table in Table 2—still more than half of the distance travelled was by car, even though trips by air were on average almost nine times longer than trips by car. Cars were used less for longer trips. For round trips between 1,600 and 3,200 kilometres, only 54 per cent of all longer-distance trips were made by car; 42 per cent were made by airplane. For round trips longer than 3,200 kilometres, 22 per cent were made by car and 75 per cent by airplane. Note that most trips with a round-trip distance of more than 3,200 kilometres were within North America, i.e., travel by car or another surface mode was an option.

Domestic and international air travel by U.S. residents, for all purposes, both increased by about 50 per cent during the 1990s (33 per cent per capita), to 2,500 person-kilometres per person in 2000. In that year, domestic travel comprised close to three quarters of all air travel

by U.S. residents.²⁸ Over the same period, travel by car—all journeys, short and long—increased by 23 per cent (nine per cent per capita).

There is also a recent survey providing a snapshot of longer-distance travel in 2001-2002 by residents of the European Union (EU15), i.e., round trips or more than 200 kilometres.²⁹ Of these trips, 13 per cent were commuting trips, 19 per cent were business trips, 28 per cent were holiday trips involving at least four nights away from home, and 41 per cent were other private trips. Thus in both the EU and the U.S., about 70 per cent of longer-distance trips are for tourism or personal business.

Some of the results of the survey of EU 15 residents are in the left-hand two columns of data in the table in Table 2. Although trips by car predominated, as they did for U.S. residents, substantially larger shares of trips by EU15 residents were made by bus or train. What is particularly noticeable is the much greater amount of longer-distance travelling performed by U.S. residents, including more than four times as many longer-distance journeys by car and more than three times as many by air.

Other data indicate that air travel by all EU residents, expressed as person-kilometres, increased by 80 per cent during the 1990s (74 per cent per capita) to 750 kilometres per person in 2000. During the same period, travel by car increased by 19 per cent (15 per cent per capita).³⁰ In spite of the huge increase in air travel in the EU, both absolutely and in relation to car travel, it remained less than a third per capita of air travel in the U.S. Only 57 per cent of EU15 residents made a longer-distance trip in 2001-2002. The equivalent percentage for the U.S. is not known, but it is likely much higher.

The sensitivity of air travel to price has been exhaustively researched. In general, as might be expected from the foregoing, tourism travel appears to be much more elastic than business travel. A recent meta-analysis found that the median of 55 estimates of the price elasticity of international long-haul tourism travel by air was -0.99, range -2.70 to -0.14; the median of 16 estimates of such travel for business purposes was -0.27, range -2.00 to -0.01.³¹

There have been few comparisons of the elasticities of tourism travel modes. The results of one are shown in Table 3,³² which provides estimates of elasticities of cost (price) and travel

Table 3. Estimates of elasticities of demand for inter-city passenger service (U.S.)

	Automobile*	Bus*	Rail*	Air*
For vacation trips:				
Cost (price)	-0.45	-0.69	-1.20	-0.38
Travel time	-0.39	-2.11	-1.58	-0.43
For business trips:				
Cost (price)	-0.70	-0.32	-0.57	-0.18
Travel time	-2.15	-1.50	-1.67	-0.16

* Each cell shows the percentage change in transport activity that would result from a one per cent increase in cost (price) or in travel time.

time for four travel modes for both business trips and tourism trips. Elasticities were higher for tourism travel (“vacation trips” in Table 3) than for business travel, except for travel by car. The conclusion might be that when prices rise tourism travellers are more likely not to travel or to switch modes, except in the case of travel by car (which can provide irreplaceable advantages for tourism travel such as access to remote places and movement of camping gear and sports equipment). Elasticities are also mostly higher for travel by rail than for travel by bus or air, which does not have a ready explanation (and may not apply outside North America).

Overall conclusions concerning tourism travel in OECD Europe and North America are these:

- The World Tourism Organization expects travel between countries to increase dramatically by 2020. However, most tourism travel appears to be within countries—notably within the U.S.—and there are no ready expectations as to how this tourism travel will change.
- Most tourism travel is by car. This is more the case in Europe than in North America, although the frequency and extent of all kinds of tourism travel in Europe is much lower. However, the rate of growth of tourism travel by air may have been much higher than that for such travel by car.
- Tourism travel seems to be highly price sensitive. However, tourism travel by may be less sensitive to changes in its price than tourism travel by other modes.

Questions: *What other data on tourism travel are available that would enhance understanding of this significant element of all travel? What might explain the large differences between EU15 and U.S. residents in the amounts of longer-distance travel?*

6. FACTORS IN TRENDS IN LEISURE AND TOURISM TRAVEL

To the extent that there are ongoing increases in leisure travel and tourism travel,³³ several potential drivers of these trends can be adduced.

For leisure travel—i.e., local travel for non-work purposes not requiring an overnight stay—relevant factors could include increased real income, reduced work hours, increased opportunity (i.e., more things to do), and increased life span. These factors could also contribute to increased tourism travel.

Cars are used for leisure travel more than for commuting in part because leisure destinations are more scattered than places of employment and because public transport is less available outside of peak periods. Land-use arrangements are often planned so as to reduce commuting requirements. Little attention has been given to land-use arrangements that reduce leisure travel. However, according to the authors of a recent paper, “Leisure time budget is dominated by social interactions with friends or relatives. It seems that with the dissolution of fixed family structures and the growing spread of social networks, it is unlikely

that policies that aim to reduce travel distances through changing the spatial structure of cities can be successful.”³⁴

Mention has already been made of the high sensitivity of both leisure travel and tourism travel to price. A recent review concluded the following: “Commuter trips tend to be less elastic than shopping or recreational trips. Weekday trips may have very different elasticities than weekend trips. Urban peak-period trips tend to be price inelastic because congestion discourages lower-value trips, leaving only higher-value automobile trips. Travelers with higher incomes tend to be less price sensitive than lower-income travelers. Travelers on business tend to be less price sensitive than people traveling for personal activities.”³⁵ Thus, leisure travel and tourism travel might be expected to increase and decrease as disposable incomes rise and fall.

Transport opportunities are a key factor for both types of travel. **Above all, patterns of leisure travel, domestic tourism travel, and in some places—e.g., Europe—international travel are determined by car ownership**, which in turn is associated with real income.³⁶ An additional factor in tourism travel is availability of relatively low cost air travel. However, good recent information about the relationship between the prices of travel by different longer-distance modes and the use of them does not seem to be available.

Moreover, tourism is actively promoted as part of economic development strategies in island and other small economies where the scope for economic diversification is extremely limited and as a means of generating economic value from maintaining biological diversity, otherwise known as ‘ecotourism’. Thus, ‘sustainable tourism’—discussed below in Section 9—is actively promoted through both national and international efforts.

Questions: *Are there land-use strategies within urban regions—other than intensification—that could reduce the amount of leisure travel? What are the roles of car ownership in both leisure travel and tourism travel?*

7. ENVIRONMENTAL IMPACTS OF LEISURE AND TOURISM TRAVEL

Leisure travel has generated relatively little concern. Most discourse about travel in urban regions, including discourse about its environmental impacts, continues to be dominated by concerns about commuting journeys. Nevertheless, the data presented here suggest that leisure/personal business travel likely comprises the largest share—even the majority—of local travel.

Getting a handle on the relative environmental impacts of leisure travel vs. say commuting trips is challenging. As well as the actual amounts of different transport activities, factors to be taken into account include (i) emission factors for the respective transport modes, for both local and global pollutants, noting that these rise for all modes in heavy traffic (although much less where electric motors are used); and (ii) vehicle occupancies, noting that car occupancies tend to be higher for leisure travel while public transport occupancies tend to be much lower. In rough terms, for leisure travel public transport’s advantages in terms of emissions factors may well be offset by its disadvantages in terms of occupancies. Thus, a reasonable

conclusion may be that overall environmental impacts reflect the relative amounts of each kind of travel, as may be derived from data such as are in Figure 1, Figure 2, and Figure 3, i.e., leisure/personal business travel has roughly twice the impact of commuting.

Tourism travel is also dominated by travel by car, but a significant and growing portion appears to concern travel by air.³⁷ From an environmental perspective, the growth in air travel is disturbing because of its apparent strong contribution to potential climate change.

Aviation contributes to potential climate change in two ways. The first is that it burns fossil fuel thereby releasing carbon dioxide. In this, it is no different from almost all other transport, except that the rate of fuel burn per second and per person- and tonne-kilometre performed are higher than for other modes.

The second way in which civil aviation contributes to potential climate change is that it results in production of ozone at the boundary of the troposphere and the stratosphere (the tropopause), i.e., at a height of about 10 kilometres. This happens to be the height at which ozone is the most effective as a greenhouse gas, and where it has a relatively long residence time.³⁸ The result, according to the Intergovernmental Panel on Climate Change (IPCC),³⁹ is that burning a litre of jet fuel at the height where most commercial aircraft vehicle-kilometres are performed has two to four times the radiative forcing effect of burning a litre of fuel at sea level. Work done since the IPCC report was prepared appears to support this conclusion.⁴⁰ There appear to be no ready solutions to aviation's strong contribution to climate change beyond attempts to increase the fuel efficiency of aircraft and to reduce the amount of air travel (and the amount of movement of freight by air).

A question that applies more to air travel than to other kinds of motorized travel is the extent to which it could be affected by the prices of suitable fuels. If worldwide petroleum production is to peak during the next few decades, as many believe,⁴¹ aviation could be affected more than other transport modes. It is the most energy-intensive mode and the mode for which there appear to be fewer prospects for alternative fuels. Relative scarcity of petroleum would thus translate into increases in the relative price of travel or transport by air compared with other modes, and demand would be dampened.

Questions: How can leisure travel be given a higher profile in transport planning? Can aviation be made more environmentally sustainable?

8. REMEDIES CONCERNING LEISURE TRAVEL AND TOURISM TRAVEL

The significant challenge with respect to leisure travel as defined here could be that of reducing the amount of it performed by car. However, substituting relatively low-occupancy public transport for relatively high-occupancy car use will not necessarily provide an environmental advantage, especially if the public transport mode is bus travel and occupancy rates remain low. Collateral measures would be required to raise public transport occupancy for leisure travel.

Table 4. Emissions per passenger by different modes, London-Edinburgh (600 kilometres)

Modes	Carbon dioxide	Nitrogen oxides	Particulate matter <10 µg	Carbon monoxide	Volatile organic compounds	Sulphur dioxide
Car	56	349	9	2 288	314	8
Air	126	104	4	137	19	10
Rail (high-speed, electric)	24	57	3	10	1	132

Note: Amounts are in grammes, except for carbon dioxide, for which amounts are kilogrammes

The simply stated remedy is attainment of more compact urban regions that both reduce the amounts of travel required and facilitate high occupancies of public transport. An extreme example is Hong Kong, where almost all motorized journeys within the urban region for all purposes are made by profitable public transport. There, seven million people live at an average density of more than 300 persons per hectare, compared with about 50 pp/ha for European urban regions and about 15 pp/ha for North American urban regions.⁴²

An alternative measure is to plan for access to specific leisure destinations by high-occupancy public transport. This can be effective but does not take into account the already noted scattered and discrete nature of the destinations of much leisure travel. An example is church-going, to the extent that it is regarded as a leisure (or personal business) activity. Churches used to serve neighbourhoods. Now, they are as likely to serve communities of particular faiths whose members do not necessarily live within walking distance.

Yet another strategy is to obviate motorized travel by providing local access to leisure destinations, e.g., recreation centres and parks, and even shops, to the extent that shopping is a form of leisure (or personal business). As with the deliberate planning of travel to larger destinations, this can be a partial remedy within a large urban region.

Reducing car use may also be the most significant challenge for tourism travel (see Table 2). However, replacing it by air travel would not provide a net environmental advantage, as illustrated in Table 4.⁴³ Air travel results in less overall ground-level local and regional pollution, but considerably more global pollution in the form of greenhouse gas emissions (carbon dioxide, in this case).⁴⁴

Table 4 also points to a remedy, namely **substitution of high-speed rail for longer-distance travel by car or air.** Except for sulphur dioxide emissions, high-speed rail is environmentally superior. Sulphur dioxide emissions could be reduced by regulation of fuels used for electricity generation. Because travelling at lower speeds generally involves less fuel use, substitution of lower-speed rail—if electric—would result in greater environmental advantages.

The emissions estimates in Table 4 depend critically on vehicle occupancy, which is assumed to be two persons for the car journey and 33 and 65-75 per cent respectively for the rail and air journeys.⁴⁵ For example, if the car carried four persons, and the other occupancies were unchanged, carbon dioxide emissions would be similar to those for high-speed rail, although emissions of most other pollutants would still be far greater. This consideration nevertheless points to a second remedy for reducing the environmental impacts of tourism travel, namely

achieve the highest possible vehicle occupancies (which may already be achieved in many charter flights to tourist destinations).

Questions: Will the possible persistence of high transport fuel prices impact leisure travel and tourism travel enough to reduce environmental impacts without public policy intervention? In the absence of high market prices and actions to accommodate them, should the thrust of policy-making be to reduce amounts of leisure travel and tourism travel or to change how they are performed?

9. SUSTAINABLE TOURISM

This paper has proceeded so far with hardly a mention of ‘sustainable tourism’, a concept that together with ‘ecotourism’ has moved to the centre of discourse about tourism activity. The World Tourism Association (WTO) developed a definition of sustainable tourism as early as 1988. In 1995, the WTO, the World Travel and Tourism Council and the Earth Council formulated an Agenda 21 for the Travel and Tourism Industry.⁴⁶ In the follow-up to the Earth Summit in Rio de Janeiro in 1992 and Agenda 21, the United Nations General Assembly (UNGA) at its nineteenth special session in 1997 included sustainable tourism as a sectoral theme in the *Programme for the Further Implementation of Agenda 21*.⁴⁷ In 1999, at its seventh session, the United Nations Commission on Sustainable Development tasked a multi-stakeholder working group led by the WTO with co-ordinating the implementation of an international work programme on sustainable tourism development. The working group, which included the United Nations Environment Programme among others, identified 11 priority issues covering numerous aspects of sustainable tourism development, including transport. In 2001, the UNGA adopted a *Global Code of Ethics for Tourism*, which included references to energy use and infrastructure issues in the context of sustainable development, and affirmed the right to tourism and the freedom of tourism movements.⁴⁸ The World Summit on Sustainable Development in Johannesburg in 2002 adopted a Plan of Implementation agreed by Heads of State and Government, which includes a commitment to promote sustainable tourism development.⁴⁹

Most recently, in February 2004, the Parties to the Convention on Biological Diversity adopted Guidelines on Biodiversity and Tourism Development.⁵⁰ The WTO and UNEP have organised conferences on sustainable tourism in small island developing states (SIDS) and other islands (1988), on ecotourism (2002),⁵¹ and on tourism and climate change (2003),⁵² among others. The WTO has developed a set of sustainability indicators on tourism,⁵³ which include some on transport, and has developed recommendations for supporting and/or establishing national certification schemes for sustainable tourism,⁵⁴ which also include a transport dimension.

Ways to address the environmental impacts of tourism travel are taken up in many of the documents and work products note above. They include, among others, recommendations to:

- develop and promote cost-effective, efficient, less polluting transport systems at tourist destinations;

- ensure that new tourism developments are located in areas well served by high-occupancy public transport or where provision of such transport is included as part of the planning proposal;
- devote attention to efficient transportation management, especially as regards air and road transport;
- develop more energy efficient and cleaner technology and logistics;
- use well maintained and modern transport technologies thus minimising emissions, particularly with respect to air travel;
- integrate land-use and transport planning to reduce transport demand;
- use renewable energy sources in tourism and transport companies;
- help customers make more climate friendly choices;
- help staff of tourist facilities and customers use environmentally friendly transport (car-sharing, cycling, walking, public transport);
- work with suppliers to avoid delivery at peak times and to ensure that delivery vehicles are fully loaded;
- undertake assessment of the potential impacts on biodiversity of infrastructure projects related to tourism;
- undertake assessment of the potential impacts on air quality and climate change from pollutants and greenhouse gases related to tourism travel;
- include in certification schemes for sustainable tourism core and supplementary criteria for different tourism products and services, including transportation;
- include in the support of certification schemes appropriate environmental indicators related to transport services (public transport, environmentally friendly alternatives).

Notwithstanding some of the above recommendations, the huge effort to ‘green’ much tourism activity has focussed on what happens at destinations. This focus is caught well in the material of the National Geographic Society on sustainable tourism, which is introduced as follows:

The travel and tourism business is now perhaps the largest industry on Earth. While tourism can build understanding, tourism managed poorly can ruin a place. Yet if handled well, tourism provides an incentive to preserve the best things a destination has to offer: wildlife habitats, historic districts, great scenery—even a style of music or a unique local cuisine.⁵⁵

Such considerations point to the final question for workshop participants:

Question: Are transport issues sufficiently addressed in efforts to promote sustainable tourism?

10. QUESTIONS POSED

Questions following Section 2:

Is the definition of leisure travel proposed here useful? Is 'leisure travel' the best term for local, discretionary travel? How should the case of shopping as a leisure activity be handled?

Questions following Section 3:

Is the definition of tourism travel proposed here useful? If not, what would be a more satisfactory definition?

Questions following Section 4:

What would be the best categorisation of local travel that would facilitate analysis of leisure travel as defined here? What other data on leisure travel are available that would enhance understanding of this significant element of all travel?

Questions following Section 5:

What other data on tourism travel are available that would enhance understanding of this significant element of all travel? What might explain the large differences between EU15 and U.S. residents in the amounts of longer-distance travel?

Questions following Section 6:

Are there land-use strategies within urban regions—other than intensification—that could reduce the amount of leisure travel? What are the roles of car ownership in both leisure travel and tourism travel?

Questions following Section 7:

How can leisure travel be given a higher profile in transport planning? Can aviation be made more environmentally sustainable?

Questions following Section 8:

Will the possible persistence of high transport fuel prices impact leisure travel and tourism travel enough to reduce environmental impacts without public policy intervention? In the absence of high market prices and actions to accommodate them, should the thrust of policy-making be to reduce amounts of leisure travel and tourism travel or to change how they are performed?

Question following Section 9:

Are transport issues sufficiently addressed in efforts to promote sustainable tourism?

END NOTES

- ¹ The proceedings of the ECMT's Round Table No. 111 appear as *Transport and Leisure*. Paris, European Conference of Ministers of Transport, Paris, 2000.
- ² The 2002 OECD document *Household Tourism Travel: Trends, Environmental Impacts and Policy Responses*, (document ENV/EPOC/WPNEP(2001)14/FINAL, available at the URL below) was prepared by Philippe Crist for the Environment Directorate's Programme on Sustainable Consumption (Working Party on National Environmental Policy).
1. [http://www.oilis.oecd.org/olis/2001doc.nsf/43bb6130e5e86e5fc12569fa005d004c/1df9e50b1b092650c1256b9f0034b213/\\$FILE/JT00124673.PDF](http://www.oilis.oecd.org/olis/2001doc.nsf/43bb6130e5e86e5fc12569fa005d004c/1df9e50b1b092650c1256b9f0034b213/$FILE/JT00124673.PDF). Accessed October 16, 2004.
- ³ For example, see the *Leisure Travel News*, discontinued in 2001, which concerned the marketing of longer-distance travelling for pleasure.
- ⁴ For an example of the widest use of the term 'leisure travel', see Schlich R et al, Structures of Leisure Travel: Temporal and Spatial Variability. *Transport Reviews*, 24(2), 219-237, March 2004. In this paper, leisure travel included both the travel referred to in Note 3 and travel for at least the following purposes: (a) excursion: culture; (b) meeting friends; (c) meeting relatives; (d) going for a walk/hiking; (e) going out in the evening; (f) active sports; (g) window shopping; and (h) club meeting.
- ⁵ An example of use that appears to exclude longer-distance travel is the use in *Glossary for Transport Statistics*, 2003, produced by several international organizations (ECMT, UNECE, EU) and available at the URL below. In this document, a distinction is made between (a) travel for work and education (commuting); (b) travel for business; (c) travel for holidays (vacation); and (d) other travel, which includes travel for shopping, leisure, and family [visits].
1 <http://www1.oecd.org/cem/online/glossaries/GloStat3e.pdf>. Accessed October 16, 2004.
- ⁶ For indications that shopping is a leisure activity, consider the following:
 "The culture of shopping has now evolved into the ultimate experience and has shot up to being the number one leisure activity worldwide". (See the first URL below.)
 "For some people shopping is a pleasure, a leisure activity – at least some of the time." (See the second URL below.)
 "shopping is the newest 'leisure' activity" (See the third URL below.)
 "enjoying themselves by either shopping or participating in any other leisure activity" (See the fourth URL below.)
 "many people cited shopping as a leisure activity, and they felt that an online shopping experience using a PC or a TV didn't replicate the leisure experience of shopping" (See the fifth URL below.)
 "Consumers see shopping as a leisure activity; they want to be educated and entertained" (See the sixth URL below.)
 "This report provides deeper insights into today's consumers' shopping behaviour by assessing the extent to which people shop because they like it and find it an acceptable way of spending their leisure time. The report examines who goes shopping for pleasure, how often they go, who they go with and where they go, both for longer, all-day trips to major centres as well as shorter trips to more local destinations." (See the seventh URL below.)
 "Shopping is the number one activity of U.S. travelers today. TIA reports that 91 million people—63% of adult travelers—included shopping as a leisure activity on a trip in 2000" (See the eighth URL below.)
 "44% of Welsh people saw shopping as a leisure activity, and three in five said it was their favourite way to spend their spare time" (See the ninth URL below.)
 "Many Japanese individuals consider shopping as a leisure activity" (See the tenth URL below.)
 "New Zealanders have also taken to shopping as a leisure activity" (See the eleventh URL below.)
 "About one fifth treat grocery shopping as a leisure activity" (See the twelfth URL below.)
 1. <http://www.maltatoday.com.mt/2001/1223/ipoll.html>. Accessed October 16, 2004.
 2. <http://www.ncc.org.uk/pubs/pdf/ecommerce.pdf>. Accessed April 14, 2004.

3. http://www.imqs.ie/resources/pdf_archive/conf93%207%20Steve%20D%20Cotterell.pdf. Accessed April 14, 2004.
 4. <http://www.parliament.the-stationery-office.co.uk/pa/cm199394/cmhansrd/1993-11-29/Debate-8.html>. Accessed October 16, 2004.
 5. http://www.alcatel.com/bnd/dsl/mip/Exec_Summary_A4_P3.pdf. Accessed October 16, 2004.
 6. http://www.pittsburghlive.com/x/tribune-review/living/greenthumb/s_181711.html. Accessed April 14, 2004.
 7. <http://reports.mintel.com/sinatra/mintel/new/report/reprcode=0164&anchor=a93/doc/57178956&reprcode=0164>. Accessed October 16, 2004.
 8. <http://www.arc.gov/index.do?nodeId=1903>. Accessed October 16, 2004.
 9. http://icwales.icnetwork.co.uk/0100news/0200wales/content_objectid=13611619_method=full_siteid=50082_headline=-One-in-ten-will-spend--pound-1-000-filling-children-s-stockings-this-Christmas-name_page.html. Accessed October 16, 2004.
 10. http://www.athill.com/english/English/no7/7_hill5.html. Accessed October 16, 2004.
 11. <http://library.christchurch.org.nz/Connect/1998/79/bookreviews.asp>. Accessed October 16, 2004.
 12. <http://oregonstate.edu/dept/IIFET/2000/abstracts/kinsey.html>. Accessed October 16, 2004.
- 7 For the words of Kofi Annan, see the URL below.
 1. <http://www.world-tourism.org/newsroom/Releases/2004/february/un.htm>, Accessed October 16, 2004.
 - 8 For the definition of tourism, see the Web site of the World Tourism Organization at the URL below.
 1. http://www.world-tourism.org/statistics/tsa_project/TSA_in_depth/chapters/ch3-1.htm. Accessed October 16, 2004.
 - 9 There are several misrepresentations in the literature as to the WTO's definition, perhaps because of recent changes in that definition. One source claims, "The World Tourism Organization (WTO), an intergovernmental organization, defines tourism as situations where an overnight stay is involved." (See Page 633 of Button KJ, *Travel, tourism, and the environment*. In Hensher DA, Button KJ, *Handbook of Transport and the Environment*, London UK, Pergamon, 2003). This is evidently contrary to the WTO statement that "Tourism displacement can be with or without an overnight stay". Another source claims that the WTO defines tourism as "travel to a country other than that in which the traveller has his/her usual residence ...". (See Page 5 of *Tourism: Austrian Development Cooperation Sector Policy*, March 2001, available at the URL below. Although this statement represents the way the WTO produces statistics (see text), it does not represent a requirement in WTO's current definition of tourism.
 1. <http://www.retour.net/Resourcecenter/WebDocuments/documents/Ausdevdocs/Sector%20policy%20of%20the%20Austrian%20Development%20Cooperation.doc>. Accessed October 16, 2004.
 - 10 See, for example, *Tourism Highlights, Edition 2003*, available from the World Tourism Organization at the URL below.
 1. http://www.world-tourism.org/market_research/facts/highlights/Highlights.pdf. Accessed October 16, 2004.
 - 11 Information on longer-distance travel by U.S. residents is from the long-trip dataset of the *2001 National Household Travel Survey*, as reported in *Highlights of the 2001 National Household Travel Survey*, Bureau of Transportation Statistics, U.S. Department of Transportation, 2004, available at the URL below.
 1. http://www.bts.gov/publications/national_household_travel_survey/highlights_of_the_2001_national_household_travel_survey/pdf/entire.pdf Accessed October 16, 2004.
 - 12 The data in this paragraph and the categories used are from the source detailed in Note 11.
 - 13 The requirement for at least one overnight stay is of course arbitrary. It may be seen as a compromise between the WTO definition of tourism, which specifically requires no overnight stay (see Note 8), and definitions that require more than one overnight stay (e.g., the paper by Heinze GW, *Transport and Leisure: Growth as an Opportunity*, pp. 5-51 of the document detailed in Note 1).

- ¹⁴ Figure 1 is based on data presented in Figure 1 of the source detailed in Note 13.
- ¹⁵ The similarity between trip lengths for the commuting and leisure trips represented in Figure 1 is evident from the similarity of the ratios of the shares of these trips: 1.04 in the case of commuting trips and 1.06 in the case of leisure trips.
- ¹⁶ Figure 2 is based on the author's analysis of the day trip dataset of the *2001 National Household Travel Survey*, Bureau of Transportation Statistics, U.S. Department of Transportation, 2004. Details of the survey and of how the CD-ROM containing the results can be obtained are at the URL below. Trip purposes were arranged to correspond as far as possible with those for German travel summarized in Figure 1. Survey documentation, reachable through the URL below, explains how estimates based on the day trip dataset may differ from estimates based on the longer-trip dataset, use of data from which is indicated in Notes 11 and 12.
1. http://www.bts.gov/programs/national_household_travel_survey/. Accessed October 15, 2004.
- ¹⁷ See Note 6 for indications that much travel for shopping can be regarded as leisure travel.
- ¹⁸ The data in Figure 3 are from Table A-1 of Schafer A, Regularities in travel demand: An international perspective, *Journal of Transportation and Statistics*, 3(3),1-31, 2000, available at the URL below. Note that data from 1975-1977 are represented in Figure 3 as being for 1976; data from 1982-1986 as being for 1984; data from 1989-1992 as being for 1990; and data from 1994-1996 as being for 1995. Discrepancies from Figure 1 and Figure 2 may exist because (i) only local travel is represented in Figure 3; (ii) different years are represented, particularly for the U.S.; (iii) different geographic extents are represented, particularly in the case of Germany; and (iv) there may be definitional differences among the data sources.
1. http://www.bts.gov/publications/journal_of_transportation_and_statistics/volume_03_number_03/pdf/entire.pdf. Accessed October 16, 2004.
- ¹⁹ This indication corresponds to that for Germany in Figure 1 but not to that for the U.S. in Figure 2, where leisure and personal business trips were both shorter than work trips. However, this could be an artefact of the way the purposes were assembled in Figure 2 for comparison with Figure 1.
- ²⁰ The data for London in Table 1 were taken from Transport for London's *London Travel Report 2003*, available at the first URL below. The data for Toronto are from the author's analysis of the 2001 Transportation Tomorrow Survey, information about which is available at the second URL below.
1. <http://www.tfl.gov.uk/tfl/pdfdocs/ltr/london-travel-report-2003.pdf>. Accessed October 16, 2004.
2. <http://www.jpint.utoronto.ca/dmg/tts.html>, Accessed October 16, 2004.
- ²¹ The U.S. occupancy data are from the source detailed in Note 16.
- ²² According to the International Energy Agency, car occupancies in Europe are as follows: commuting 1.1-1.2; family trips 1.4-1.7; travel and leisure, 1.6-2.0. These estimates are reported by the European Environment Agency in Table 1 of the 2001 document *Occupancy Rates*, available at the below. The same source suggested that car occupancy rates in EU countries have been declining.
1. http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/technology/occupancy,2001/Occupancy_rates_TERM_2001.pdf. Accessed April 16, 2004.
- ²³ For reviews of elasticities with particular reference to public transport, see *The Demand for Public Transport: A Practical Guide*, TRL Ltd., UK (2004), available at the URL below.
1. <http://www.demandforpublictransport.co.uk/TRL593.pdf>, Accessed October 16, 2004.
- ²⁴ For example, the recently developed "tourism satellite accounting" for the World Travel & Tourism Council (see the documents at the URL below) does not provide information about travel costs for domestic and international tourism. The indicated documents estimate that globally tourism and travel in 2003 directly comprised 2.8% of employment and 3.8% of GDP; considering direct and indirect impacts, the shares were 8.1% (employment) and 10.4% (GDP). The corresponding shares

for the European Union were 4.8% and 4.3% (direct), and 12.8% and 11.5% (direct and indirect). The corresponding shares for North America were 4.2% and 4.0% (direct), and 11.3% and 10.4% (direct and indirect).

1. <http://www.wttc.org/2004tsa/frameset2a.htm>. Accessed October 16, 2004.

- ²⁵ See the source detailed in Note 24 for worldwide expenditures on personal travel and tourism, and the source detailed in Note 10 for international tourist arrivals.
- ²⁶ See the source detailed in Note 10.
- ²⁷ The data in this and the next paragraph, and those in Table 2, are from the source detailed in Note 11. A previous survey of longer-distance travel had been conducted: the 1995 *American Travel Survey*, a report on which is available at the URL below. The U.S. Bureau of Transportation Statistics, for whom both surveys were conducted, has advised that because of definitional changes data from the two surveys cannot be directly compared (see Page 12 of the source detailed in Note 11).
1. http://www.bts.gov/publications/1995_american_travel_survey/. Accessed October 16, 2004.
- ²⁸ The data on air travel by U.S. residents is from *National Transportation Statistics*, U.S. Bureau of Transportation Statistics, 2003, available at the URL below. Note that both domestic and international air travel declined in 2001 and again in 2002.
1. http://www.bts.gov/publications/national_transportation_statistics/2003/index.html. Accessed October 16, 2004.
- ²⁹ The survey of longer-distance travel in the EU (which also concerned Switzerland, not reported here) was conducted for the European Commission's Directorate-General for Energy and Transport. It is reported in 'Deliverable 7: Data Analysis and Macro Results' of *DATELINE (Design and Application of a Travel Survey for European Long-distance Trips Based on an International Network of Expertise)*, available at the first URL below. A conference presentation of the results is available at the second URL below. Note that the survey addressed persons aged 16 and older. Used here, to provide comparability with the U.S. data are results as presented for the whole EU15 population. Another recent source of information about tourism travel in Europe is Peeters P, van Egmond T, Visser V, *European tourism, transport and environment*. Second draft deliverable 1 for the DG-ENTR MusTT project, August 2004. This 106-page document, which does not appear to be available on the Web, provides a trip-based rather than a population-based analysis. Therefore, its results are not strictly comparable with the DATELINE work and the U.S. survey
1. <http://cgi.fg.uni-mb.si/elmis/docs/D7%20-%20Data%20Analysis%20and%20Macro%20Results%20110703.pdf>. Accessed October 16, 2004.
2. <http://www.ivt.baum.ethz.ch/allgemein/slides/broeg.pdf>. Accessed October 16, 2004.
- ³⁰ Data on air travel by EU residents are from *European Union: Energy & Transport in Figures*, European Commission Directorate-General for Energy and Transport, 2003, available at the URL below.
1. http://europa.eu.int/comm/dgs/energy_transport/figures/pocketbook/doc/etif_2003.pdf, Accessed October 16, 2004.
- ³¹ Gillen DW, Morrison WG, Stewart C, *Air Travel Demand Elasticities: Concepts, Issues and Measurement*. Department of Finance, Government of Canada, January 2003, available at the URL below.
1. http://www.fin.gc.ca/consultresp/Airtravel/airtravStdy_e.html. Accessed October 16, 2004.
- ³² Table 3 is from Morrison SA, Winston C, *An Econometric Analysis of the Demand for Intercity Transportation*. *Research in Transportation Economics*, 2, 213-237, 1985, as reported in U.S. Congressional Budget Office, *The Past and Future of U.S. Passenger Rail Service*, September 2003, available at the URL below.
1. <http://ntl.bts.gov/lib/24000/24100/24127/09-26-PassengerRail.pdf>. Accessed October 16, 2004.

- ³³ Possible uncertainty as to whether either leisure travel or tourism travel is increasing in extent is reflected in the following conclusion for Germany from the source detailed in Note 4 (where the definition of leisure travel embraced what is included here as leisure travel and tourism travel): “At present, there is not even clear evidence of the increasing share of leisure travel as compared with other trip purposes”. The chief uncertainty is in the larger share comprising leisure travel as defined here rather than tourism travel, which, at least during the 1990s, was very much on the increase.
- ³⁴ The quote is from Page 235 of the source detailed in Note 2.
- ³⁵ The quote is from the section on ‘Transportation elasticities’ in the *Online TDM Encyclopedia*, Victoria Transportation Policy Institute, 2003, available at the URL below.
1. <http://www.vtpi.org/tdm/tdm11.htm>. Accessed October 16, 2004.
- ³⁶ For evidence of the relationship between income and car ownership, see Dargay JM, The effect of income on car ownership: evidence of asymmetry. *Transportation Research Part A*, 35, 807-821, 2001.
- ³⁷ For a discussion of the environmental impacts of tourism travel, see the source detailed in Note 2.
- ³⁸ For a discussion of the impacts of aviation on the global climate see Lee D, Raper D, The global atmospheric impacts of aviation. In Thomas C et al (eds.), *Towards Sustainable Aviation*, Earthscan, London UK, 2003. According to Lee and Raper, ozone is formed at this height because the high temperature causes the nitrogen and oxygen in the air to combine to form first nitric oxide and then nitrogen dioxide (NO₂), collectively known as nitrogen oxides. NO₂ catalyzes production of ozone, essentially through speeding up a naturally occurring process. The process breaks down another greenhouse gas in the atmosphere, methane, but not in sufficient quantities to offset the additional greenhouse effect provided by the added ozone. The net result is an increase in radiative activity (global warming effect).
- ³⁹ See Penner JE et al (eds), *Aviation and the Global Atmosphere, A Special Report of IPCC Working Groups I and III*. Cambridge University Press, Cambridge UK, 1999.
- ⁴⁰ See the source detailed in Note 38.
- ⁴¹ For a compelling discussion of the prospects for petroleum production, see *Oil-based technology and economy prospects for the future*. The Society of Danish Engineers, Copenhagen, Denmark, December 2003, available at the URL below.
1. http://www.tekno.dk/pdf/projekter/p04_Oil-based_Technology_and_Economy.pdf. Accessed October 16, 2004.
- ⁴² See Gilbert R, *Electrifying Hong Kong: Making transport sustainable*. Civic Exchange, Hong Kong, February 2002, available at the URL below.
1 <http://www.civic-exchange.org/publications/2002/Hong%20Kong%20paper%205.pdf>, Accessed October 16, 2004.
- ⁴³ The table in Table 4 is adapted from Table 10 of *A comparative study of the environmental effects of rail and short-haul air travel*. Commission for Integrated Transport, UK, September 2001. The chief difference from the source is the use of a car occupancy of two persons rather than one, to provide a closer approximation to typical occupancies for leisure travel (see Note 22).
1. <http://www.cfit.gov.uk/reports/racomp/pdf/racomp.pdf>. Accessed October 16, 2004.
- ⁴⁴ The estimates of carbon dioxide emissions in Table 4 are actual emissions and do not take into account the radiative forcing that could result from production of ozone at the boundary of the troposphere and the stratosphere, as discussion in the previous section.
- ⁴⁵ See Note 43 for the car occupancy estimate and the source detailed in Note 43 for the occupancy of trains and airplanes.

- ⁴⁶ See the URL below.
1. <http://www.wttc.org/promote/agenda21.htm>. Accessed October 16, 2004.
- ⁴⁷ See the URL below.
1. <http://www.un.org/documents/ga/res/spec/aress19-2.htm>. Accessed October 16, 2004.
- ⁴⁸ See the URL below.
1. http://www.world-tourism.org/code_ethics/eng.html. Accessed October 16, 2004.
- ⁴⁹ See the URL below.
1. http://www.johannesburgsummit.org/html/documents/summit_docs/2309_planfinal.htm. Accessed October 16, 2004.
- ⁵⁰ See the URL below.
1. <http://www.biodiv.org/programmes/socio-eco/tourism/guidelines.asp>. Accessed October 16, 2004.
- ⁵¹ See the URL below.
1. http://www.world-tourism.org/sustainable/TYE/quebec/anglais/index_a.html. Accessed October 16, 2004.
- ⁵² See the URL below.
1. <http://www.world-tourism.org/sustainable/climate/brochure.htm>. Accessed October 16, 2004.
- ⁵³ See the URL below.
1. <http://www.world-tourism.org/cgi-bin/infoshop.storefront/EN/product/1020-1>. Accessed October 16, 2004.
- ⁵⁴ See the URL below.
1. <http://www.world-tourism.org/cgi-bin/infoshop.storefront/EN/product/1232-1>. Accessed October 16, 2004.
- ⁵⁵ The quote is from the source at the URL below.
1. <http://www.nationalgeographic.com/travel/sustainable/>. Accessed October 16, 2004.