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Working Party on National Environmental Policy
Working Group on Transport

PROJECT ON ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST)

Report on the OECD Conference ENVIRONMENTALLY SUSTAINABLE TRANSPORT (EST): FUTURES, STRATEGIES AND BEST PRACTICE

Palais Auersperg, Vienna, Austria
4-6 October 2000

This is the final report on the OECD conference Environmentallys Sustainable Transport: Futures, Strategies and Best Practice, held in Vienna from 4-6 October 2000. Please note that the complete document is only available in .pdf format

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FOREWORD

The past century saw extraordinary growth in the movement of both people and goods. This growth has contributed to major social and economic advances, but it now increasingly erodes some of the very benefits it has brought about. In particular, current trends in transport activity pose severe challenges for progress towards sustainable development.

In response to the problems posed by transport for sustainability, the OECD initiated the Environmentally Sustainable Transport (EST) project in 1994. Since then, this major project has involved participants in 25 countries directly and indirectly. A conference held in Vienna from 4-6 October, 2000—hosted by the Government of Austria—was a culmination of work on the EST project. This document is the report on that conference, which had the title *Environmentally Sustainable Transport (EST): Futures, Strategies and Best Practice*.

At the conference, over 300 participants from five continents presented and discussed the findings and implications of the EST project, and examined the challenges to be encountered in securing progress towards EST. As well as members of the expert teams that had worked on the EST project, conference participants included a wide range of government officials and representatives of business and of non-government organisations.

After three days of discussion, the conference participants adopted *EST Guidelines* for decision-makers concerned to develop policies towards sustainable transportation. The *EST Guidelines* and the several thousand pages of project reports form the concrete output of the EST project. The *EST Guidelines* in particular capture the wisdom and understanding gained through work on the project. They should be of considerable use to governments over the next few decades.

The potential value of the *EST Guidelines* has already been recognised in the endorsement of them by OECD Environment Ministers at their meeting held in May 2001.

This Conference Report is published on the responsibility of the Secretary-General.

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EXECUTIVE SUMMARY

This document is a report on the proceedings of a conference entitled *Environmentally Sustainable Transport (EST): Futures, Strategies and Best Practice* held in Vienna, Austria, from 4-6 October, 2000.

The conference was the culmination of the OECD's EST project, conducted over the period 1994-2000 and involving directly and indirectly some 25 Member and other countries.

The EST project sought to determine how transport in OECD countries could become more sustainable. An important outcome of the project is a set of *EST Guidelines*, endorsed at the conference, that can help decision-makers formulate policies for moving towards sustainable transport.

This report sets the context of the conference, summarises and synthesises the presentations and discussions at the conference, and presents the *EST Guidelines*. The report draws conclusions about current transport trends, about progress towards EST and about what the next steps should be.

Section 1 of the report briefly sets the context of the conference and describes the *Synthesis Report*, a document prepared to provide conference participants with a common basis of relevant information. This section also outlines the EST project itself and describes the *est! best practices* competition held in conjunction with the conference.

Section 2 is the main section of this report. It comprises brief summaries of all of the conference presentations. These appear in the approximate order of their presentation at the conference, with minor adjustments to facilitate thematic coherence. (Appendix B contains authors' abstracts of most of the presentations.) A few of the several hundred slides presented at the conference are reproduced here, selected as much to reflect the broad scope of the conference as to indicate the importance of particular material.

Section 3 briefly presents the *EST Guidelines* as adopted by participants on the final day of the conference. The *EST Guidelines* synthesise the wisdom and experience gained through the EST project, presented in a form of value to decision-makers and others concerned to secure progress towards EST. The post-conference document on the *EST Guidelines* provides a fuller exposition of them. This document is reproduced here as Appendix D.

Section 4 draws conclusions from the conference discussions. The most important of these are perhaps the following:

- **Transport may be the sector of human activity that presents the greatest challenges with respect to sustainable development.** Technological achievements have been offset by growth in transport activity and vehicle size, and there is great resistance to change.

- **Transport behaviour is not well understood.** For example, little information is available—at least in the public domain—about the factors that determine ownership and use of motorised personal vehicles. Understanding such matters could be essential for the development of effective strategies to change transport behaviour.

- **The EST approach is appropriate and necessary, and was strongly endorsed.** Conference participants said that conventional approaches to transport activity have not worked because they have not set sustainability-linked targets for the reduction of the broad range of transport's impacts. Target-setting is a prerequisite for the development of effective strategies, which must be clearly linked to the targets.

- **Development of indicators of progress towards EST should be a priority.** We can know whether progress is being achieved only to the extent we can measure progress. Where possible, indicators of progress should be based on the EST criteria, as they are refined. Establishment of EST criteria and targets and the development of indicators need to go hand-in-hand.

- **The difficulty of changing attitudes has been underestimated.** The project's emphasis on these matters was considered appropriate. Their importance has nevertheless been underestimated. Much more work is required on how attitudes to transport change and can be changed, and on what will be required to secure public acceptance of the need to move towards EST.

- **The main challenge—implementation of EST—lies ahead**; the EST project has been only a beginning. Much must be done to consolidate this initial work. Particular matters requiring further investigation include, among others, the EST criteria themselves—notably in respect of noise, fine and ultra-fine particles, and land use—and also resource use and the 'upstream' and 'downstream' aspects of transport activity. Attention must be given to the barriers to attainment of EST, notably social and psychological barriers, and to the social and economic implications of moving towards EST.

Appendix A reproduces the conference programme. Appendix C contains a list of conference participants.

1. INTRODUCTION

1.1. The Vienna conference

The international conference entitled *Environmentally Sustainable Transport (EST): Futures, Strategies and Best Practice* was held at Vienna's Palais Auersperg from 4-6 October, 2000. It was hosted by the Government of Austria and organised by the Organisation for Economic Co-operation and Development. The Vienna conference was the culmination of the OECD's Environmentally Sustainable Transport (EST) project involving some 25 countries across the world in a search for a new approach to help solve today's transport problems. It was the second of two international conferences that served as significant milestones for the EST project.[1†]

The Vienna conference was the culmination of the EST project

The main purposes of the Vienna conference were these:

- to present the global challenges of sustainable transport
- to set out the key features and results of the EST project to a broader audience, and discuss the project's conclusions and recommendations
- to highlight a range of specific solutions for passenger and freight transport that combine technological breakthroughs and mobility management strategies, and to illustrate them with best practices examples
- to consider and endorse a set of guidelines for moving towards EST
- to address the organisational and structural changes necessary for EST as well as social and economic implications of moving towards EST.

Over the three days of the conference, more than three hundred delegates from five continents discussed these and many other aspects of the world's transport problems. The introductory and keynote addresses by several Ministers, Secretaries of State, and senior policy-makers broadly supported the EST approach and stressed the importance of putting it into practice.

300 delegates from five continents

The EST project has been conducted over the last five years under the direction of the OECD Environmental Policy Committee's Working Group on Transport (formerly the Task Force on Transport).

† Superscript numbers refer to End Notes beginning on Page 145.

The main conclusion from the project

The main conclusion drawn from the EST project is that there is a new way towards a sustainable transport future. It involves:

(i) defining what is meant by sustainable transport;

(ii) developing a vision of what transport will be like when it is sustainable; and

(iii) working out how to realise the vision.

This approach differs from the usual way of thinking about transport's problems, which is to focus on present problems and devise short-term remedies for them that may even conflict with the long-term goals of sustainable development. Further information about the EST project is provided in Section 1.3 below.

Guidelines endorsed by OECD Environment Ministers

Participants in the conference also discussed and endorsed ten guidelines that governments everywhere can use to put transport on a sustainable path (see Section 3 below and Appendix D). The *Vienna EST Guidelines* will help governments address the challenges of environmental degradation and resource depletion caused by transport. They provide the essential steps for action. The *Guidelines* were subsequently endorsed by OECD Environment Ministers at their meeting in May 2001.

International competition

An international competition on *est! best practices* was organised in connection with the Vienna conference. It highlighted promising examples of progress towards EST in the fields of technology, mobility management, communication and awareness raising, culture, education, and the arts. After the opening remarks, 'Best Practices' awards were presented to 18 of the 43 entries to the competition at an award ceremony introduced by a performance of the *EST Walzer*, composed for the conference and performed by the i Musichieri ensemble, Zurich.

The *est! best practices* finalists included community organisations, businesses, and public authorities. The entries were described as "exemplary practices" rather than literally *the* best practices. Each community or business is unique, and what works well in one place may be no more than a guide and a source of ideas as to how things might best be done in another. The finalists were also given the opportunity to display their projects at the conference site. Further information about the Best Practices competition appears in Section 1.4.

1.2. The *Synthesis Report*

The *Synthesis Report*[2] provided conference participants with a common base of information about transport trends and impacts, and about the EST project (described in Section 1.3). The *Synthesis Report* also provided summaries of the *est! best practices* displayed at the conference.

The survey of transport trends and impacts in the *Synthesis Report* noted the remarkable rate of growth in the motorised transport of people and freight during the 20th century. While the world's population grew by a factor of about four, motorised person-kilometres and tonne-kilometres by all modes (including ocean freight) each grew on average by a factor of about 100, with large variations in growth rates among countries and regions, and across time. Initially, growth in motorised transport bring more benefits than costs, but mobility levels in and between many OECD countries now appear to be such that further growth in transport activity brings more costs than benefits.

At first, motorised transport bring more benefits than costs; then costs can exceed benefits

Transport's benefits were described in the *Synthesis Report* in these words: "The growth in motorized mobility has been mostly positive. It has facilitated and even stimulated just about everything regarded as progress. It has helped expand intellectual horizons and deter starvation. It has allowed efficient production and the ready distribution required for widespread consumption. Comfort in travel is now commonplace, as is access to the products of distant places."

Transport's costs were discussed in terms of transport's global environmental impacts, its regional and local environmental impacts, and its use of non-renewable resources. Chief among transport's global impacts is its contribution to climate change. Air pollution is the main regional and local impact, with major effects on human and ecosystem health. Direct and indirect effects on land and production of noise are also major concerns. Oil is the most obvious non-renewable resource used by transport. The combustion of oil products, chiefly diesel fuel and gasoline (petrol), accounts for the largest portions of transport's environmental impacts. Transport is also a major user of other increasingly scarce resources, including numerous exotic elements used in vehicles' electronic systems.

The *Synthesis Report* concluded that transport's present trajectory is not sustainable. Steps are being taken to mitigate many adverse environmental impacts, but their effects are offset by the growth in transport activity. Overall costs are beginning to exceed overall benefits. Moreover, assessments of the condition of ecosystems throughout the world indicate that the impacts of human activity must be substantially reduced if the only home of humanity in the universe is to remain habitable. Present transport activity is among the major sources of these adverse impacts. New approaches to transport are required.

Transport's present trajectory is not sustainable

1.3. The EST project

The *Synthesis Report* continued by describing the EST project and the new approach to the management of transport activity that evolved during the course of the project.

Definitions of EST

This approach begins with characterisation and definition of environmentally sustainable transport and with justification of the premise that attainment of EST as defined should be a primary objective of transport policy. Participants in the EST project defined an environmentally sustainable transport system as one where:

> *transport does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes.*

More specifically, a sustainable transport system was considered to be one that throughout its full life-cycle operation:

- *allows generally accepted objectives for health and environmental quality to be met, for example, those concerning air pollutants and noise proposed by the World Health Organization (WHO);*
- *is consistent with ecosystem integrity, for example, it does not contribute to exceedances of critical loads and levels as defined by WHO for acidification, eutrophication, and ground-level ozone; and*
- *does not result in worsening of adverse global phenomena such as climate change and stratospheric ozone depletion.*

Criteria for EST

Internationally agreed goals, guidelines, and standards were used to operationalise these characterisations of EST in the form of EST criteria and reduction targets. Six criteria were identified as being the minimum number required to address the wide range of health and environmental impacts from transport. These criteria concerned emissions of carbon dioxide, nitrogen oxides, volatile organic compounds, and particulates, as well as noise and land use. Among the most challenging criteria was the one concerning carbon dioxide (CO_2) emissions. An 80-percent reduction in CO_2 emissions was considered necessary to meet sustainability objectives. During work on the project, participants determined that for the most part the criteria concerning other impacts would be met if the CO_2 criterion were met. Resource issues were assumed to be addressed if the six criteria were met. Another particularly challenging criterion concerned noise abatement.

Visions of EST

The six expert teams from the nine countries participating in the main EST project developed visions (known as 'scenarios') of what EST would be like in 2030. The EST scenarios chosen for further examination represented combinations of technological improvements to vehicles, fuels, and infrastructure, on the one hand, and changes in transport activity (transport demand management), on the other hand. There were wide variations among the project teams as to how these two kinds of factor were balanced. Overall, technological improvements contributed some 46 per cent of the changes required in respect of the movement of freight, and just over 40 per cent of the changes required in respect of the movement of people.

Technology can do less than half of what is required for EST

The above work comprised Phases 1 and 2 of the EST project. In Phase 3 of the project, the most extensive phase, the project teams developed packages of instruments whose implementation would result in attainment of the EST scenarios. As well, there were preliminary assessments of the economic and social implications of moving towards and achieving the scenarios. In Phase 4, the project teams developed the *EST Guidelines* adopted at the Vienna conference (set out in Section 3 below).

Related national EST studies

In addition to the core project, related national studies were undertaken by Austria, France, and Japan. A further related study concerned Central and Eastern European economies in transition, conducted jointly by UNEP, the OECD, and Austria under the Central European Initiative (CEI).[3]

Reports on the EST project

Reports on each of Phases 1, 2, and 3 of the EST project are available, as follows:

Phase 1: *Environmental Criteria for Sustainable Transport* (OECD, 1996). See also the separate volume, *Compendium of Expert Papers: Studies presented in the context of the OECD's Environment Directorate's EST project* (OECD, 1996).

Phase 2: *Scenarios for Environmentally Sustainable Transport*. Volume 1: *Overview Report*. Volume II: *Individual Project Case Studies*. (OECD, 1998, updated in 1999)

Phase 3: *Policy Instruments for Achieving Environmentally Sustainable Transport.* Volume 1: *Overview Report*. Volume II: *Individual Project Case Studies*. (OECD, 2001)

These reports and others associated with the project are available on request to the OECD Secretariat and at the Web site of the EST project at <www.oecd.org/env/ccst/est>.

1.4. *est! best practices* competition

The *Synthesis Report* contains one-page descriptions of each of the submissions by the finalists in the *est! best practices* competition. A total of 43 entries were received. Eighteen projects that are in operation or funded were selected for display at the conference using the following criteria: contribution to sustainability; impacts on transport, environment, and health; degree of innovation; potential for awareness raising; and potential for further adoption. The 18 finalists are listed below, organised by the categories in which submissions had been requested:

18 *best practices* finalists

- Communication and awareness raising
  - Publicity and information campaign for public transport. (AS Oslo Sporveier, Norway)
  - Individualised marketing in public transport: an innovative approach to reduce motorised public transport. (Socialdata, Munich, Germany)
  - Branding: A new marketing approach for changing customer awareness towards public transport. (Wiener Linien, Austria)
- Mobility management for freight transport
  - Company-wide CO_2 reductions through green supply-chain management. (Otto Versand, Hamburg, Germany)
  - Emission calculation—transport-chain emission profiling for clients. (BTL Schenker AG, Gothenburg, Sweden)
- Mobility management for passenger transport
  - Promotion for sustainable mobility, public transport, and carsharing, Bremen. (Freie Hansestadt Bremen, Germany)
  - Company mobility management in the hospital of Tulln. (Landeskrankenhaus Tulln)
  - Company mobility management in the Vorarlberg media office building. (Media Haus Bregenz)
  - Langenlois, the traffic-saving community. (Langenlois, Austria)
  - Integrated mobility services in Switzerland. (Mobility Carsharing Switzerland)
  - Sustainable mobility—car-free tourism. (Trafico, Wien)
- Technology and infrastructure
  - Introduction of natural-gas-fuelled city buses in Hungarian public transport. (Institute for Transport Sciences, Budapest)
  - SmILE fuel efficiency technology. (Greenpeace, Germany)
  - Carless city—the alternative project for mobility in Spoleto. (Comune di Spotelo)
  - Hydrogen bus—zero emissions and targets for public transport (Azienda Torinese Mobilità, Italy)
  - RAVel: Dedicated soft mobility network in Wallonia, Belgium. (Ministère de la region wallone)
- Youth and education
  - Off ramp: School car trip reduction programme. (Better Environmentally Sound Transportation, B.E.S.T., Vancouver, Canada)
- Culture and the arts
  - The renaissance of Kassel's central station. (Kulturbahnhof Kassel, Germany)

2. OVERVIEW OF THE CONFERENCE PRESENTATIONS

2.1. Opening remarks and policy statements

The conference opened with addresses by Austrian Federal Minister **Wilhelm Molterer**, OECD Deputy Secretary-General **Thorvald Moe**, City of Vienna Executive Councillor **Fritz Svihalek**, and the head of the government for the Greater Vancouver Regional District, **George Puil**.

Mr. Molterer said that what he liked about the EST project was its emphasis on targets and on indications of feasibility. He noted that cooperation on matters concerning EST was improving, within and among governments including governments at different levels. What is needed above all, he said, were better ideas. He saw the EST project as a rich source of useful proposals.

What is needed above all, are better ideas

Mr. Moe spoke to the origins of the EST project, specifically (i) the conclusion of *Agenda 21* (UNCED, Rio de Janiero, 1992) to the effect that sustainability requires each sector of society to become sustainable, and (ii) the 1998 OECD Environmental Ministerial meeting that requested the development of guidelines for implementing EST principles. He noted that transport is a particularly challenging sector and emphasised his conviction that "business as usual is no longer an option".

Origins of the EST project

Councillor Svihalek extended a welcome to participants as the person responsible for transport and environment in the City of Vienna, urging all to walk a lot. He noted several features of Vienna's transport system, including City-subsidised electric cars and bicycles, car sharing, and special funding for buses in lower-density areas. He urged the wise spending of funds, especially for rail.

Chairman Puil made a strong link with the Vancouver conference.[4] He noted the major influence of that conference on the development of transport and land-use planning—and above all governance structures—in the Vancouver Region. He underscored the significance of the sustainable transport principles adopted at the Vancouver conference, and anticipated that the *EST Guidelines*, for consideration at this conference, will have an even greater impact.

Link with the 1996 Vancouver conference

2.2. Policy statements and other opening presentations

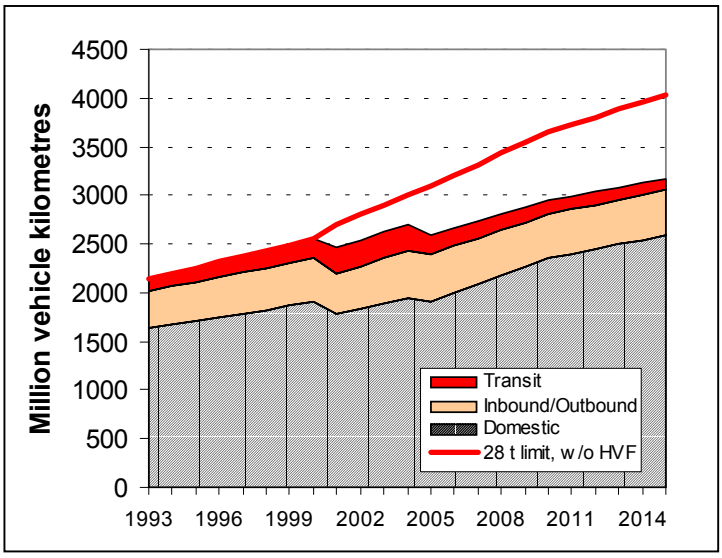
Need to make sustainability meaningful

Gila Altmann, Parliamentary State Secretary, German Ministry of Environment, stressed the need to make sustainability both meaningful and acceptable to the 'person on the street'. The EST project was an important step in this direction, which provided a strong reason for her government's participation in the project. Ms. Altmann stressed the need to unlink mobility from car ownership; we need good mobility and access, but we do not need a lot of traffic. She noted inequities regarding transport planning, which is mostly done by men, from the perspective of the car driver during commuting. Women's reality is neglected, especially in urban areas. She emphasised the need for international cooperation on transport sustainability. The EST project is a good example of such cooperation, a further reason for her government's support for the project.

Switzerland's integrated transport policy

Max Friedli, Secretary of State for Environment, Government of Switzerland, began by saying, "The OECD's EST project is a valuable contribution and approach to managing the ever-increasing growth of transport and to moving towards the sustainable development of this sector". He focused on Switzerland's integrated transport policy. This addresses the need to reduce demand for motorized mobility and to integrate the different transport modes. Notable features are the major investment programme for railway infrastructure, especially the new Alpine transit (NEAT), and the distance- and performance-related heavy-duty vehicle fee (HVF) designed to internalise external costs and partly finance the new rail infrastructure. Using these and other complementary measures, transalpine freight transport is expected to grow much less than without the HFV and the actual weight limit for lorries of 28 tonnes (see Box 1). Mr. Friedli stressed the need for international coopera-

▶ Box 1
Evolution of road freight in Switzerland



tion, and expressed his hope that the results of the EST project will raise awareness in all OECD countries as to what is required to meet the sustainability requirements agreed to at the 1992 UNCED conference.

Leo Bjornskov, Deputy Secretary of State, Danish Ministry of Environment, highlighted the importance of the EST project in showing that sustainable transport is a viable alternative to 'business as usual'. He spoke to the need for a framework convention on transport and environment, with the international automotive industry at the table as a non-governmental organisation. The aim of the convention would not be to put an end to the car but to reach outside the OECD and build a transport for the future.

Need for a framework convention on transport and environment

Rolf Annerberg, head of cabinet for the EU's Environment Commissioner, described the theme of the conference as bold and as encouraging because it gave us hope for a transport system that will serve our needs while protecting both the environment and our sanity. He set out the definition of sustainable transport used by European Commission experts,[5] and argued that there is no single magic solution and no single route to the attainment of this "ultimate aim". He said that what we really mean by this concept is "enabling our children and their children to enjoy the benefits from transport that we have today while still living in an intact environment" He added that we are far away from this ideal and moving farther away all the time. The global environmental impacts of aviation require special attention.

The global environmental impacts of aviation need attention.

Danuta Hübner, Executive Secretary, United Nations Economic Commission for Europe, linked this EST conference to the meeting of European Ministers of Transport and Environment held in Vienna in 1997 and the Program of Joint Action agreed at that meeting. Ms. Hübner expressed strong agreement with how sustainability criteria were developed and used in OECD's EST project, particularly criteria derived from the critical loads and levels approach developed in the framework for the Convention on Long-range Trans-boundary Air Pollution. The development of sectoral targets from these overarching goals and attainment of them are major challenges that must be faced.

Use of the critical loads and levels approach endorsed

Frits Schlingemann, director of United Nations Environment Programme's regional office for Europe, described the holding of the Vienna conference as an excellent and timely initiative. He hoped it would lead to renewal and expansion of work on environmentally sustainable transport. He stressed that governments need to look beyond conventional approaches towards a new generation of transport policies, with a full life-cycle perspective from manufacturing to disposal especially for emis-

sions of greenhouse gases (GHGs). Governments should abandon transport policies that continue to favour non-sustainable systems.

The speakers during the conference's first morning all endorsed the EST project as having made a significant contribution to thinking about sustainable transport. They welcomed the proposed *Guidelines* as providing necessary advice to OECD Member country governments and others.

2.3. Keynote address on sustainable development of transport

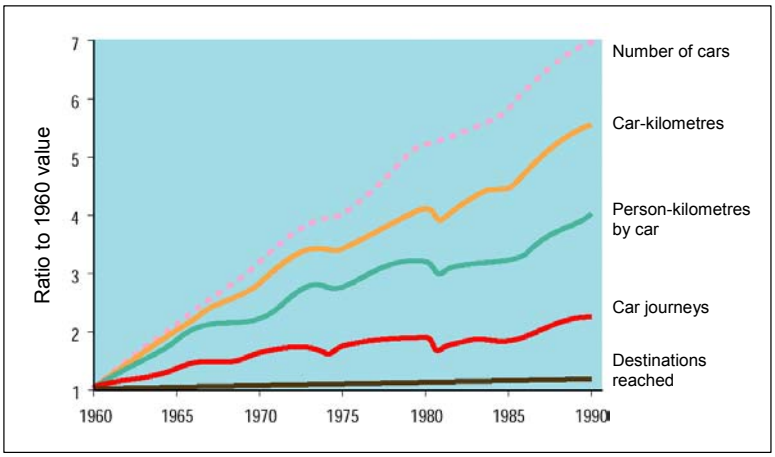
A miracle to people in medieval times

Professor **Ernst-Ulrich von Weizsäcker**, President of the Wuppertal Institute for Environment, Energy and Climate, gave the main keynote presentation. It was entitled: *Sustainable development—a huge challenge for the transport sector*. He said, "Transport is … the most characteristic sector of unsustainable growth", and, "Mobility has been a dream of humans since time immemorial … [It] symbolises both freedom and power … The transport of goods and commodities is the key indicator of the (geographical) division of labour, which in turn stands for economic progress. … What we have now would have been a miracle to people in medieval times". Professor von Weizsäcker touched on the global risks of increasing resource use given the high growth of motorised transport, particularly in the developing world, and also on the urgency of achieving factor-four improvements of resource use so as to remain within the limits set by nature.

The difference between mobility and access

A feature of Professor von Weizsäcker's presentation was a powerful demonstration of the difference between mobility and access, reproduced here as Box 2.[6] He showed data for the former west Germany indicating that between 1960 and 1990 there was a seven-fold increase in the number of cars on the road, smaller increases in the numbers of car-kilometres (five-

▶ Box 2
Mobility in the Federal Republic of Germany, 1960-1990



to six-fold), in person kilometres travelled by car (four-fold), and in car journeys (two-fold), and hardly any increase in the number of goals reached, i.e., the amount of access. More mobility did not appear to mean more access.

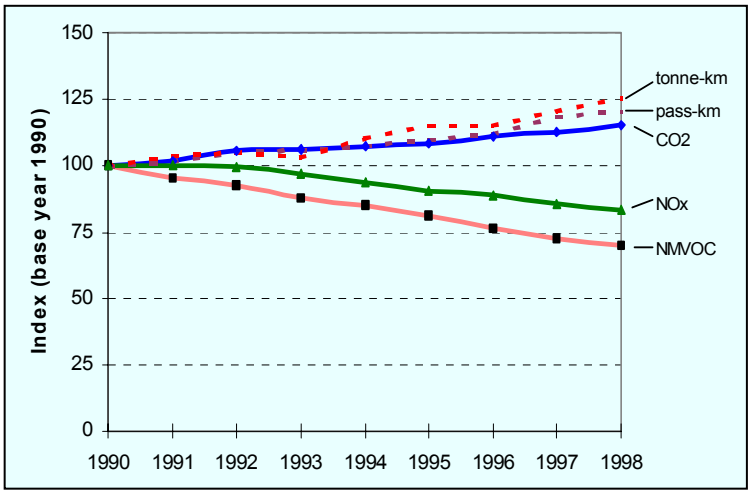
2.4. Setting the scene for EST: key issues and challenges

The scene was set for moving towards EST by substantive presentations on transport's unsustainable trends, fuel availability and use, land use impacts, air quality impacts, and noise in Europe, North America, and the Asia-Pacific region. These trends had been highlighted in the *Synthesis Report* (see Section 1.2). The presentations are briefly summarised below.

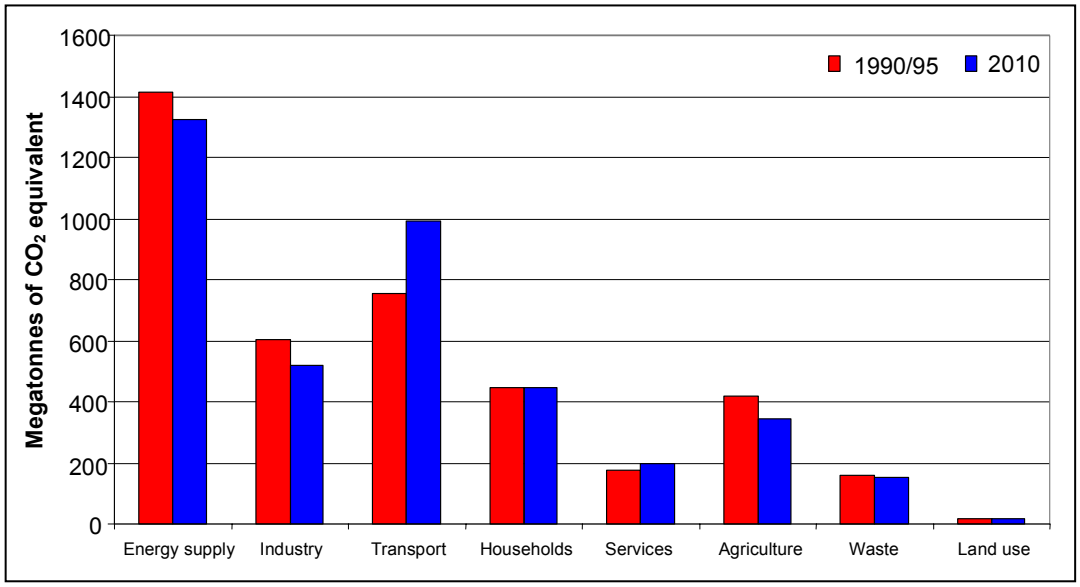
GHG emissions from transport increase, unlike other sectors

Domingo Jiménez-Beltrán of the European Environment Agency described how transport activity in EU countries is increasing, with almost corresponding increases in fuel use and emissions of GHGs, but declines in emissions of local and regional pollutants (Box 3). He showed how transport activity, unlike almost every other human activity, is projected to result in increased GHG emissions by 2010 compared with the early 1990s (Box 4). The prerequisite for progress towards EST, he said, is policy consistency.

Mr. Jiménez-Beltrán emphasised the need for effective strategies that integrate environmental concerns into transport policies, specific targets to guide EU transport in a more sustainable direction, and the need for close monitoring of progress towards the targets. He concluded with a quotation from a UK newspaper concerning the inequity of present transport arrangements (Box 5), and by saying that without eco-taxes and fair fiscal arrangements there could be no progress towards sustainability.



Box 3
Transport activity and emissions from transport, EU 1990-1996



Box 4
Emissions of carbon dioxide by sources, European Union, 1990-95 and 2010

Michael Landwehr, International Energy Agency, described IEA projections for transport energy use, focusing on OECD Pacific (Japan and Australasia) and North America. He noted expected increases in transport energy use of 27 and 39 per cent respectively by 2020, compared with 1997 (but 16 and 23 per cent if certain additional policy measures are applied). Use of cars and light trucks could be stabilised, but there is much less prospect for stabilisation of use for heavy-duty road vehicles and aircraft. Aviation is especially challenging. It accounts for more than a quarter of expected increases in transport energy use, with only a little help from expected fuel-intensity improvements. Without effective, integrated policies, the prospects are daunting.

Less prospect for stabilising use of heavy-duty road vehicles and aircraft

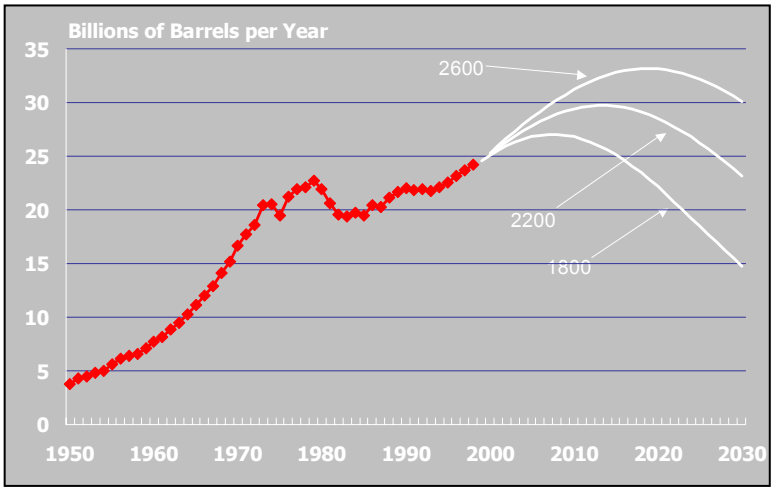
Production of conventional oil could begin to fall between 2007 and 2019

James Mackenzie, World Resources Institute, argued that ground transport practices worldwide are not sustainable for reasons of fuel resources, global warming, and increasing congestion, the last resulting from over-reliance on motor vehicles in urban areas. He discussed estimates of the ever-available amount of conventionally recoverable oil, which fuels almost all transport. These estimates lie between 1800 and 2600 billion barrels. Of this total, almost 900 billion barrels has been extracted. The rate of extraction of conventional oil will likely fall when half of the ultimately available amount has been ex-

Box 5
'Cars are not fair'

"… Yet the present system is also unfair, to those who cannot afford cars and who are driven on to inadequate public transport; to millions who live near busy main roads and motorways; to children who breath in car fumes; to people who prefer walking or cycling; to our grandchildren who may have to cope with the effects of global warming. Changing out attitudes to the car will require enormous political courage. But we cannot go on as we are."

Editorial in *The Independent* (U.K.), 19 May, 1



Box 6
Global production of conventional oil for total resource of 1800, 2200, and 2600 billion barrels

tracted. Thus, he said, production could begin to fall sometime between 2007 and 2019 (Box 6). The end of the era of cheap oil could come quite soon.

Mr. Mackenzie said that urban congestion is becoming widespread because affluence-impelled automobile traffic grows much faster than road systems. He spoke to the need to replace the automobile in urban areas with attractive, economical public transport systems that are suited to low-density living. No such system is available, but one is being developed. It is what he described as the Personal Rapid Transit system, which comprises small guided vehicles on a light-weight elevated rail network.

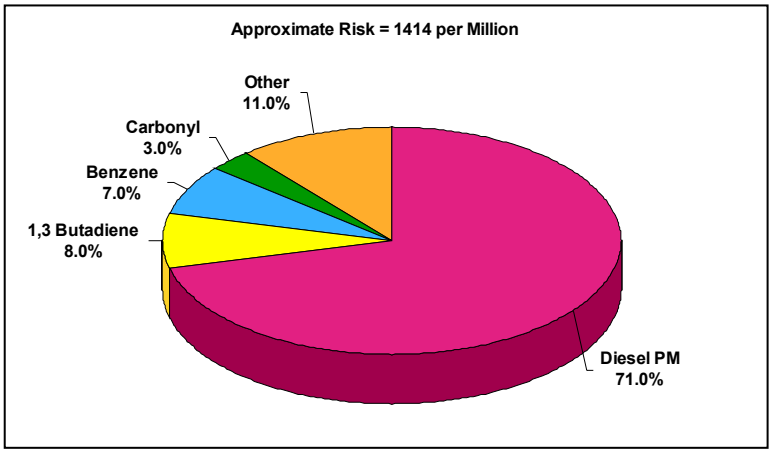
The special challenges posed by diesel engines

Michael Walsh, an independent consultant on motor vehicle issues, echoed the director of the European Environment Agency's remarks concerning recent reductions in transport-induced local and regional pollution. He made particular reference to the Los Angeles Basin, which he described as having had "the most aggressive motor vehicle pollution control programme in the world over the past 40 years". Mr. Walsh noted that between 1955 and 1993 peak ozone concentrations were cut in half. Between 1976-78 and 1991-93, the number of days on which federal zone standards were exceeded fell by 50 per cent. Nevertheless, Mr. Walsh continued, serious ozone problems remain in the U.S. He highlighted the special challenges posed by **diesel** engines. They are less energy intensive than equivalent petrol (gasoline) engines, and thus emit smaller amount of GHGs per kilometre. However, they emit higher amounts of nitrogen oxides (a key contributor to ozone production) and breathable particles considered carcinogenic by several agencies (Box 7).[7]

Fuel-efficiency gains offset by increases in vehicle power and weight

Mr. Walsh noted the relative lack of progress with respect to reductions in GHG emissions, in the U.S. and worldwide. Emis-

Box 7
Average Los Angeles Basin cancer risk apportionment

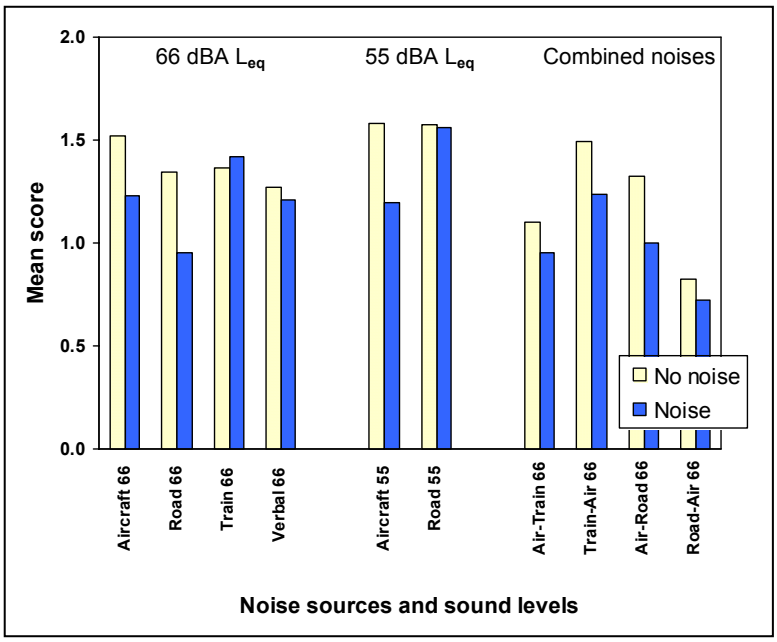


sions of the main GHG, carbon dioxide, had risen with transport activity (also see Box 3) because fuel-efficiency improvements have been mostly offset by increases in vehicle power and weight.

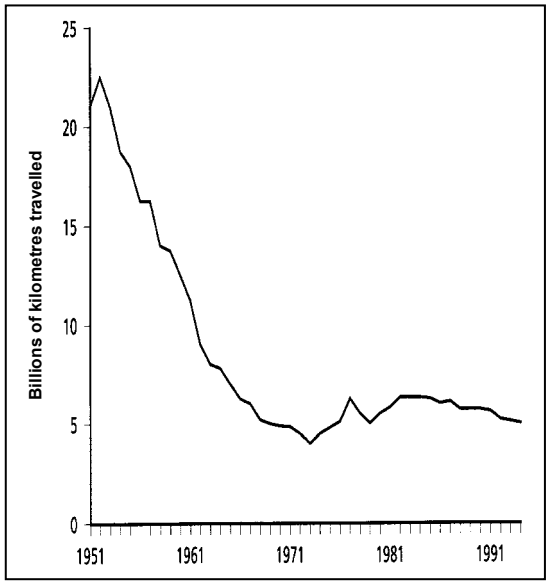
Significant adverse effects of aircraft and traffic noise

Staffan Hygge, University of Gävle, Sweden, noted the understated effect of aircraft and traffic noise on communication and cognitive processes (attention, memory, learning, and problem solving), and also on sleep. In Europe, almost 25 per cent of the population is exposed to noise levels of 65 dB or higher, i.e., at levels considered hazardous by the World Health Organization and well above the 55 dB and 45 dB thresholds for prevention of daytime and nighttime effects recommended in WHO's community noise protection guidelines. Children, the elderly, hearing impaired persons, and second-language speakers are especially affected. Mr. Hygge described several experiments that have demonstrated significant adverse effects of aircraft

Box 8
Scores on test of long-term recall by high-school students exposed to various noise types and levels



and traffic noise on the psychophysiology, cognition, motivation, and quality of life of high-school students in classroom settings. An example of the results is in Box 8, which shows the adverse effects of noise on students' long-term recall of a previously read text.



▲
Box 9
Walking and bicycling on public roads in Europe, 1951-1993

Carlos Dora of the European Office of the World Health Organization drew attention to the major health impacts of transport policies, some of which are not being considered in transport investment and decision-making. He noted particularly the decline in physical activity (Box 9). This has resulted from the use of automobiles for 30-65 per cent of the journeys that could be accomplished by walking or cycling, i.e., those less than five kilometres, with corresponding increases in clinical obesity in adults and children (in some countries, more than half the population is sedentary). Other impacts are respiratory problems and accidents, for both of which children are especially vulnerable. Mr. Dora described the *Charter on Transport, Environment and Health* adopted at the 3rd Ministerial Conference on Environment and Health held in London, UK, in June 1999. The *Charter* includes the following:

Concern about decline in physical fitness from car use

- health targets for reducing injuries and air and noise pollution and for increasing opportunities for physical exercise through walking, cycling, and use of public transport
- principles for transport that is sustainable for health and the environment
- a plan of action for the implementation of the Charter.

To help with implementation of the *Charter*, a steering group was established whose work has the following priorities: (i) review of relevant policies and legal instruments, including those concerning walking and cycling, and the development of a framework convention of transport, environment and health; (ii) development of Heath Impact Assessment tools for transport-related projects; and (iii) establishment of a clearing house and information development process.

Technology is available to cut CO_2 emissions by half

The discussion in this session focused on the need for better understanding of what technology can and cannot do, and on the overly optimistic expectations of technology particularly in relation to the prevailing low rates of vehicle turnover. Suggestions were made that regulations are not keeping up with technological advances, and that hybrid propulsion systems, in particular, are not being introduced quickly enough. Hybrid

diesel-electric vehicles offer more promise than fuel-cell vehicles in the short and medium-term. There was also discussion of the horizon for availability of conventional oil, with the suggestion that removal of carbon from emissions is a viable solution. Several speakers stressed that technology is available to reduce CO_2 emissions per kilometre by 50 per cent from conventional passenger cars, but that performance standards or requirements will be needed to ensure widespread and timely penetration of this technology.

2.5. Approaches to EST

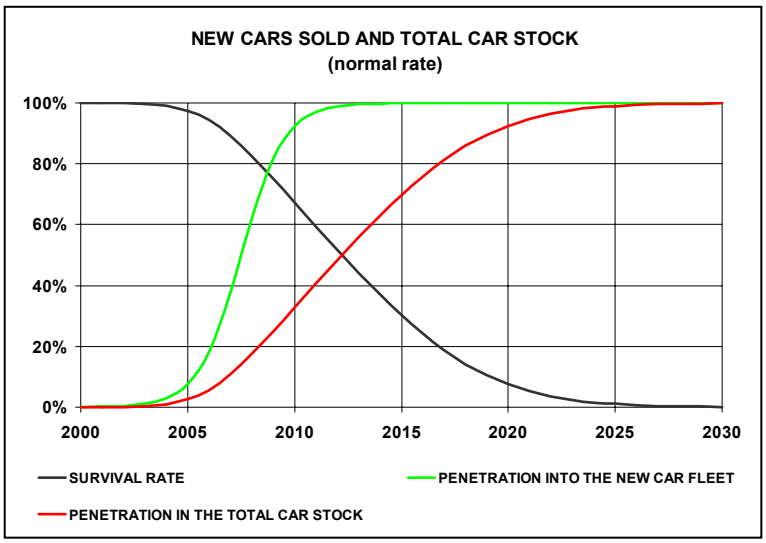
The largest number of presentations at the conference comprised reports on national, regional, and local approaches to EST, including several reports on material arising from the EST project and associated projects. Some of the salient points made during these presentations are noted here by geographic region.

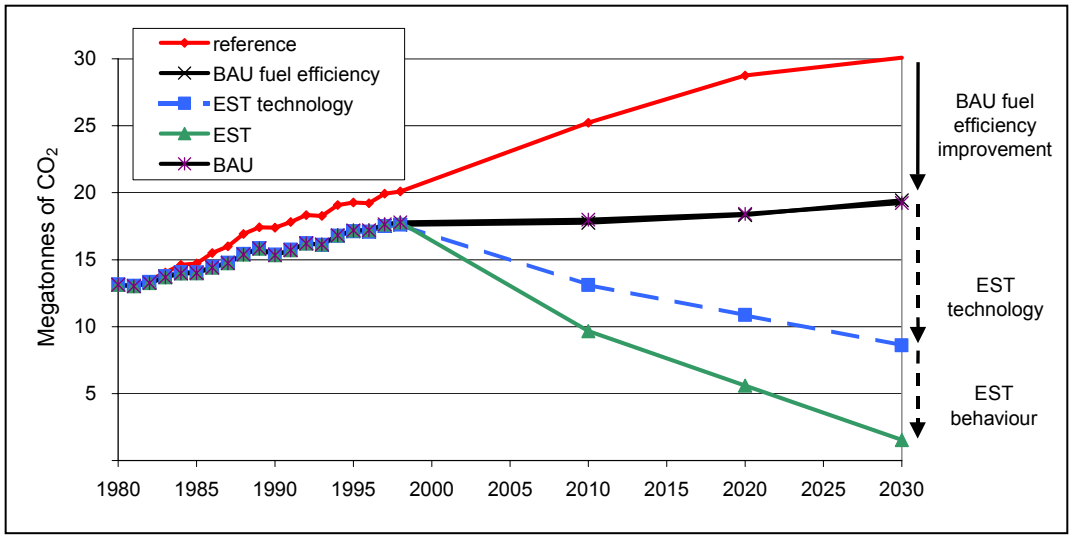
Western Europe

The largest number of presentations about approaches to EST concerned Western Europe, some from participants in the EST project. All these speakers noted the dominance of road modes and their adverse impacts, and the challenges of moving away from these modes. Many speakers stressed the importance of setting sectoral targets and the need for technological advances and demand side management measures during implement of EST strategies. Specific points made were as follows:

Alain Morcheoine, ADEME, Paris, presented work done during the EST project on the Alpine region, noting that most of the tools required for attainment of EST are already being used, and that progress towards EST will be evolutionary rather than revolutionary. The tools need to be applied in better combina-

Box 10
Illustration of rates of penetration of new technology into the new car fleet and total car stock, and the resulting vehicle survival rate





▲ Box 11
Contributions to EST-required reduction in emissions of carbon dioxide from transport in The Netherlands from expected fuel efficiency improvements, enhanced technology, and enhanced changes in transport activity

tions, with more coordination, and with greater intensity. A basic issue is the extent to which penetration of new technologies can be accelerated. Mr. Morcheoine stressed the distinction between penetration of new technology into new vehicles and into the total vehicle stock. Penetration into new vehicles is a matter of 5-10 years, but penetration into the total stock is a matter of 20-25 years, due to low vehicle turnover rates (see Box 10).

Lars Westermark of the Swedish Environmental Protection Agency discussed the Swedish EST process, which antedated the EST project and also became a part of it. This process involved eleven stakeholders (public and private entities, academia, and NGOs) who came to agree on long-term targets for the transport sector. Mr. Westermark said that EST is becoming an accepted objective across Europe.

EST is becoming an accepted objective across Europe

Karst Geurs, RIVM, The Netherlands, stressed the need for a 'trend breach' with respect to business-as-usual projections, and complementary approaches involving both enhanced technological change and enhanced change in transport activity (Box 11). Mobility patterns must be transformed; freight transport in particular must be different, with fewer goods transported and with shorter distances.

Harald Minken, TOI, Oslo, Norway, overviewed the EST project's only urban case study. He emphasised the mutual support for EST that can be provided by local and national policies; both bottom-up and top-down approaches are needed. He noted too the potential importance of introducing alternative fuel systems into urban areas through use of tax incentives. Economic impacts could be favourable nationally but less so locally, because of high public transport costs.

Noise and land-use problems cannot be resolved only by technology

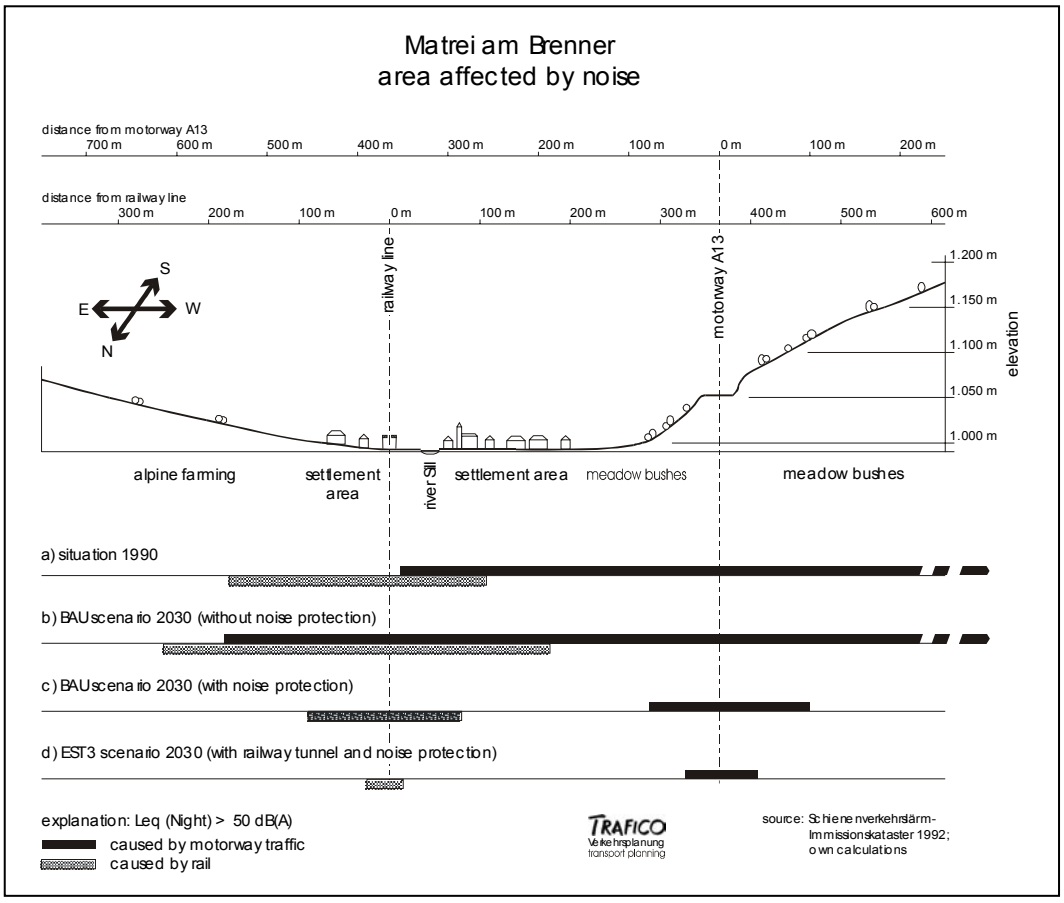
Romain Molitor, TRAFICO, Vienna, drew on the Austrian case study (part of the Alpine group in the EST project) and highlighted the particular challenges posed by attainment of the EST criteria for noise (Box 12). Noise and land-use problems cannot be resolved only by technology. Regulations must be set to secure acceptable noise levels. Also, demand management and zoning measures are required to direct development and limit urban sprawl, with targetted investment to help realise land-use objectives.

Low-traffic land-use patterns are the key to securing EST

Hedwig Verron, Federal Environment Agency, Germany, described numerous measures that could comprise Germany's strategy towards attainment of EST, including CO_2 emission limits for vehicles, fuel price increases large enough to offset efficiency gains, and large-scale traffic calming programs (Box 13). Life could be better with less transport, in denser, mixed-use, polycentric environments.

Box 12
Noise profiles in the Brenner valley in 1990 and in scenarios for 2030

Gloria Visconti, Ministry of Environment, Italy, outlined Italy's contribution to the Alpine group within the EST project. The major challenge for Italy is the great dependence on road freight. Ms. Visconti placed strong emphasis on achieving gains through mode shifts and through improved vehicle loading, and stressed the need for trans-national measures. Most of the in-



Before	Redesigning Westfleth, Buxtehude	After

struments required for Italy's attainment of EST are in use or planned; the main problems lie in the degree of implementation.

▲ Box 13
Large-scale integrated traffic calming: Redesigning Westfleth, Buxtehude

Colin Poole, Department of Environment, Transport and the Regions, UK, described the UK's 10-year investment plan to tackle adverse economic, environmental, and social impacts of recent and current transport trends. The plan is part of the government's 1999 Sustainable Development Strategy and has a strong focus on investment in public transport.

Central and Eastern Europe and the former USSR

Tremendous growth of road transport while rail-based systems deteriorate rapidly

The special issues confronting these countries were well highlighted in the closing presentation by the Minister of Environment for Hungary (Section 2.11). They concern the tremendous growth of road transport and associated demand for road infrastructure, while rail-based systems both inside and outside urban areas deteriorate rapidly. To counter these trends, large investments in infrastructure will be needed. More details on these issues can be found in the study on Central and Eastern European countries carried out within the EST project.[8] Specific points made during the conference sessions were these:

Kaj Bärlund, UN ECE, Geneva, provided an overview and highlighted the special challenges of this region arising from economic growth and from major shifts towards adverse modes of transport, particularly motorised road and air traffic. By moving quickly to advanced vehicle standards, low emission requirements, and high fuel quality, some of the mistakes of the West can be avoided; but the good environmental practices of the past should be retained.

Special challenges of Russian road-accident rates

Vadim Donchenko, Ministry of Transport, Russian Federation, said that realisation of sustainable development principles has been officially proclaimed as the main task of state transport policy. He emphasised the special challenges posed by high road-accident rates in Russia. Decision-makers do not understand transport problems, even though they become more obvious. Among recent actions taken are the following: requirement for regular vehicle inspections; toughening of fuel quality standards, environmental assessment of all major transport projects, expansion of use of compressed natural gas as a vehicle fuel, and retrofit of Moscow's municipal motor fleet with catalytic converters.

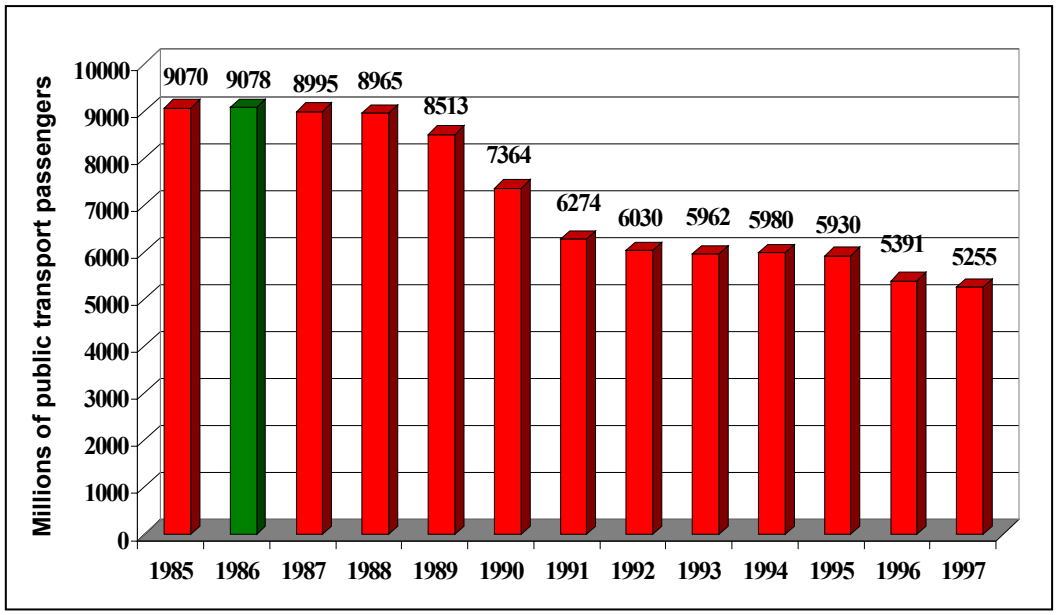
Need for strategic environmental assessment of transport plans

Axel Friedrich, Federal Environment Agency, Germany, described the work done in respect of the Baltic 21 Agenda of the Helsinki Commission on the Baltic Marine Environment (HELCOM) and the resulting focus on securing implementation of guidelines for decision-making with respect to investment in transport infrastructure that are consistent with attainment of EST. He stressed the need for strategic environmental assessment of transport plans.

Ales Sarec, Ministry of Environment, Slovenia, set out Slovenia's national EST Programme based on the work in OECD countries, and also the specific plans for the specific plans for the capital, Ljubljana, and for the North-east Adriatic Coast Region, where a regional light-rail system could help ensure progress towards sustainable transport.

Box 14
Annual public transport passengers in Poland, 1985-1997
▼

Wojciech Suchorzewski, University of Warsaw, Poland, described the problems for public transport in Poland including deteriorating infrastructure, reduced investment, and poor op-



erational conditions from private-vehicle congestion, all resulting in falling patronage (Box 14). In transition countries, the car is king and people are not prepared for constraints, even though city centres are increasingly congested and infrastructure expansion cannot cope with growth in road traffic. A notable exception is the light-rail system in Krakow, where car access to the historic city centre is restricted.

Achieving EST could be easier in eastern than in western Europe

Robert Thaler, CEI-subgroup on Transport and Environment, Vienna, described the EST project concerning Central and Eastern European economies in transition (the Central European Initiative), conducted jointly by UNEP, the OECD, and Austria in parallel to the main EST project. The main message is that achieving EST will be easier here than for the rest of Europe. The modal split is still more favourable to sustainable modes and rail-based transport has a relatively high share compared to Western Europe. The critical issue here is to secure approval of the investments needed to renew and expand rail.

Jan Janiga, Ministry of Environment, Slovak Republic, described the development of his government's Joint Action Plan on Transport and Environment, and the short-term and medium- and longer-term actions directed towards increasing the sustainability of transport. A major challenge is securing budgetary approval of the funding required for implementation of the Plan.

Americas and Japan

This group of presentations addressed a wide range of circumstances, from the high levels of automobilisation in North America to rapid development of road traffic and growing congestion in urban areas, as well as consequent increasing environmental impacts, especially in Latin American cities. Specific points made in the presentations were as follows:

Sustainable transport is moving into the policy mainstream in Canada

George Puil, Greater Vancouver Regional District, Canada, noted progress towards developing and monitoring attainment of a comprehensive vision of urban transport in Canada, and the severe constraints arising from low levels of government funding for public transport. The idea of sustainable transport is moving into the policy mainstream. Notable has been the formation of coordinating bodies for all aspects of transport in the Montreal and Vancouver regions, and direct use of taxes on gasoline for public transport funding in these two regions and also in Edmonton and Calgary. In Calgary, Canada's oil capital, the light-rail system relies on electricity generated from wind turbines (its slogan is "Ride the Wind!").

Masaharu Yagishita, Environment Agency, Japan, provided an overview of policies and measures in Japan concerning the reduction of environmental problems associated with motor

vehicles. The current focuses are on vehicle improvements, changing lifestyles and ways of conducting business, developing integrated systems of land use and transport that have low impact levels on the environment, and reduction of emissions of GHGs (for compliance with the Kyoto Protocol). In respect of the last of these focuses, Japan is seeking an appropriate balance among regulatory, fiscal, and other measures.

Elizabeth Ashbourne, World Bank, described the Bank's three-year Clean Air Initiative in Latin American cities (Buenos Aires, Lima-Callao, Rio de Janeiro, Mexico City, Santiago). The Initiative covers issues of environment, urban transport, health, energy, industrial pollution, and globally acting emissions. Its overall goals are to implement both clean air action plans and innovations in the use of low-emissions, low-carbon technologies. The procedural focuses are on facilitating exchange of knowledge and experience, fostering public participation, and securing the involvement of the private sector.

Present U.S. patterns of automobile dependency and urban sprawl are unsustainable

Richard Farrell, Environmental Protection Agency, U.S.A., described features of the Transportation Equity Act for the 21st Century (TEA-21), founded on the recognition that present patterns of automobile dependency and urban sprawl are unsustainable. He noted that dense, infill urban development instead of sprawl can reduce air emissions by 40-50 per cent, and described the Smart Growth Network established to facilitate liveable, 'transit-friendly' neighbourhoods.

Expected 40% growth in CO_2 emissions from transport in Japan, 1990-2010

Yoshitsugu Hayashi, Nagoya University, Japan, noted the expected 40-per-cent growth in CO_2 emissions from transport in Japan from 1990 to 2010. Combinations involving advanced technology, capacity constraints, and tax measures could achieve significant results, in the order of a 17-per-cent reduction in GHG emissions compared to projected trends.

Lee Sims, IBI Group, Canada, described the Canadian contribution to OECD's EST Project. Deployment of a wide range of measures was proposed. They aimed at achieving reductions in transport activity, improvements in technology, better utilisation of transport, and mode shifts. Meeting all EST targets by 2030, notably the CO_2-reduction target, presents special challenges for Canada, notably because road traffic growth is driven chiefly by a high rate of population increase (which results from high rates of immigration).

World-wide

The main challenges beyond OECD countries and those of Central and Eastern Europe and the former USSR concern the special concerns with respect to developing countries. Two presentations included some focus on these concerns, as follows:

Zmarack Shalizi, World Bank, Washington, asked whether it is possible for developing countries to 'leapfrog' unacceptable patterns of mobility. He described the Bank's infrastructure investments and policy reforms, which are increasingly environmentally sensitive. About 15 per cent of the Bank's lending is for transport projects, amounting to $3 billion annually. Mr. Shalizi asked whether developing countries can expand and transform their transport networks in decades rather than centuries, and whether they can draw on the experience of OECD to alter their transport mode dependency targets and the paths by which they reach these targets. He suggested that a major problem for developing countries is that the dream of their political leaders is American-style mobility with its high auto dependency. This will necessarily lead to massive pollution, congestion, accidents, and resource depletion with associated high social costs, all of which could be avoided by adoption of more balanced approaches.

Can developing countries 'leapfrog' unacceptable patterns of mobility?

The dream is American-style mobility

Peter Histon, World Business Council for Sustainable Development, Geneva, described WBCSD's Sustainable Mobility project, a three-year, industry-led venture that is assessing current transport trends, developing a vision of future mobility, and providing strategic direction for industry. The vision will take into account the access needs of the developing world, as well as population increases and the necessity of economic growth in poor countries, while ensuring that transport's contribution to the growth is sustainable. Mr. Histon said that the report assessing current mobility trends would be issued in 2001.[9] The main *Sustainable Mobility 2030* report will be ready in 2003. It will address technological advances, emissions, fuel efficiency, climate change, urban planning, roads, public transport, resource use and conservation, safety, public health, employment, knowledge, and government policies.

2.6. Economic implications of moving towards EST

Preliminary work on the economic implications of EST

The EST project focused on the environmental aspects of sustainability, which provide the framework for all considerations of sustainability. Economic considerations arise more in the selection of means for achieving EST than in the specification of sustainability criteria. Assessment of means requires understanding of the economic implications of available strategies for attainment of EST. Accordingly, in the EST project, preliminary work was done on the economic implications of moving towards and attaining EST, set out in Volume I of the Phase 3 report detailed above in Section 1.3. The overall conclusion of this work was that the long-term macro-economic impacts are slight, but that structural changes for moving towards a sustainable transport system are required. Some of this work was

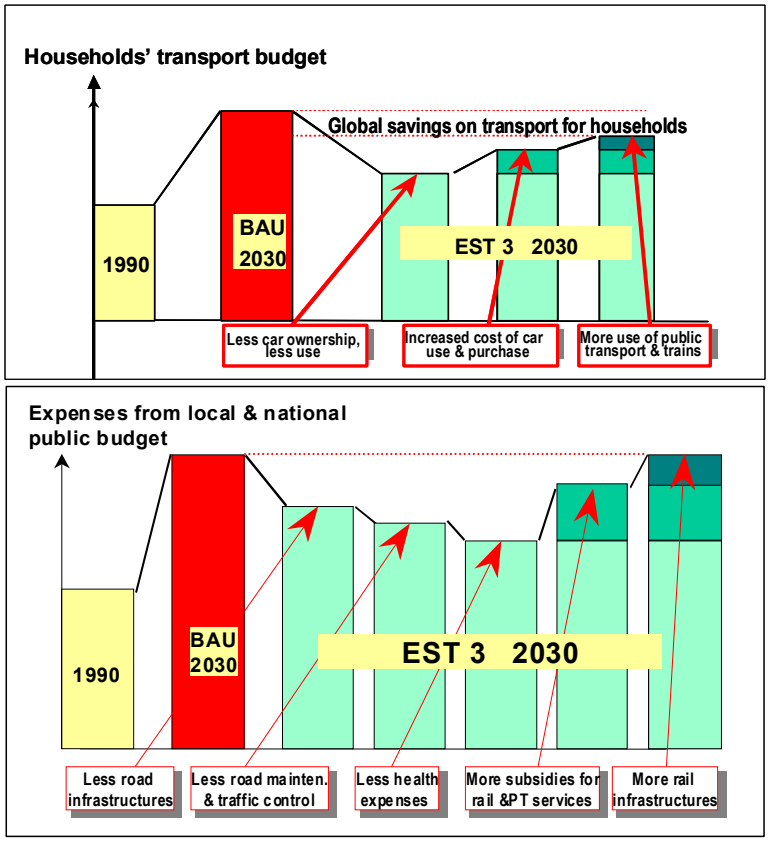
presented at the Vienna conference in the first three papers summarised below. The fourth paper presented a regional programme to identify and enhance the 'sustainable transport sector'.

Bertrand Chateau, ENERDATA, Grenoble, France, described the potential structure of household budgets and those of local and national governments under EST, as compared with business-as-usual projections. Household expenses would decline; those of governments in the Alpine countries would remain unchanged (Box 15). He also described the sagas of the 'Alpinetree families', developed in connection with the work on the Alpine region in OECD's EST project to illustrate how households and businesses could fare if EST prevailed.

Relaxing the CO_2 criterion to a 50% reduction by 2030 produces positive economic results

Werner Rothengatter, University of Karlsruhe, Germany, reported on estimates of the economic implications of EST for Germany made using sophisticated system dynamics modelling. Attainment of the EST target of an 80-per-cent reduction in CO_2 emissions by 2030 (compared with the 1990 level) would have possible negative impacts on employment compared with business-as-usual projections, but would not provoke an economic breakdown. Relaxation of the CO_2 criterion to provide for a 50-per-cent reduction by 2030, and an 80-per-cent reduction by 2050, could result in many positive indicators—including consumption, final demand, GDP, and employment—as long as

Box 15
Schematic changes in household and government budgets with EST



appropriate policies were implemented to ensure progress towards EST. Transport spending in general could be lower with EST than with 'business as usual'. As well, external costs would be lower.

Increased incentives for home production

Karl Steininger, University of Graz, Austria, outlined estimates of the economic implications in 2015 of progress towards EST for Austria developed through use of a general equilibrium model. There would be an overall increase in employment arising from shifts in sectoral demand, substitution of unpaid self-driving to public transport with paid personnel, and a slowing of the rate of real wage increases. The unemployment rate would thus fall slightly compared with 'business as usual'. Transport costs would increase and annual GDP growth would decrease by 0.1 percentage points, i.e., within the usual error tolerance limit. There would be several sectoral gains and losses, all within ±10 per cent of the average. For sectors with a high import share involving large road distances, including textiles and clothing, there could be increased incentives for home production.

Sue Zielinski, City of Toronto, Canada, described the Moving the Economy programme, which seeks to attract investment to and create jobs in the sustainable transport sector in the Toronto region and beyond. Information sharing is a major aspect of the programme, in particular 'MTE On-line', a searchable database of economic case studies in sustainable transportation (available at <www.city.toronto.on.ca/mte>).

2.7. Social implications of moving towards EST

The social aspects of sustainability fall somewhere between environmental aspects, which largely determine sustainability goals, and economic aspects, which are more to do with the means of attaining the goals. The EST project also carried out preliminary work on the social implications of moving towards and attaining EST, set out in Volume I of the Phase 3 report detailed above in Section 1.3. Available methodology required that this work be even more tentative in nature than the work on economic implications. The focus of this part of the Vienna conference was on bringing new other work to the forefront rather than on presenting relevant parts of the EST project.

Udo Becker, University of Technology, Dresden, Germany, discussed societal goals for transport. He made a distinction between 'mobility' and 'traffic', the former arising because people's needs cannot be satisfied entirely at home, and the latter being the instruments for mobility comprising the resources and costs of transport. Raising the efficiency of transport—defined as the ratio of mobility and traffic—is a key goal.

Sustainable transport requires better consideration of women's needs

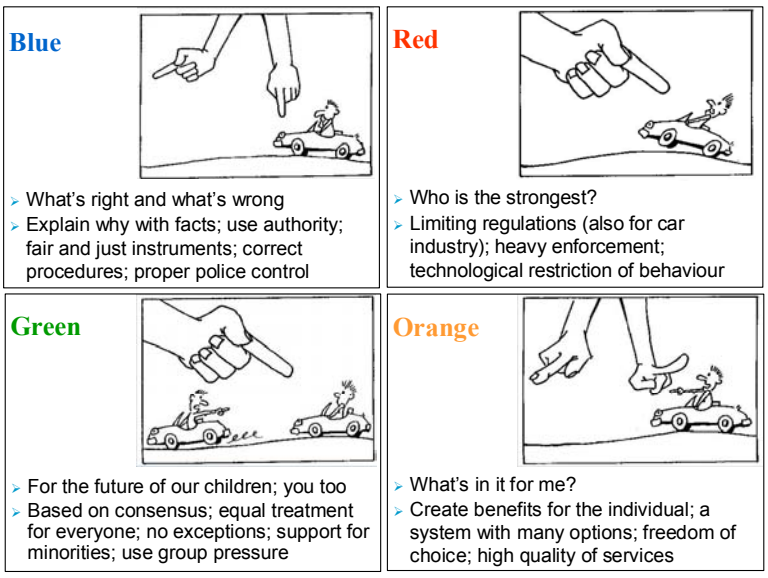
Christiane Jasper, Federal Environment Agency, Berlin, Germany, discussed mobility and gender issues. She noted that car transport is a male enterprise; women, children, and the elderly have different needs. Women want environmental sustainability, perhaps to avoid their children being killed when they walk to school rather than by choice.

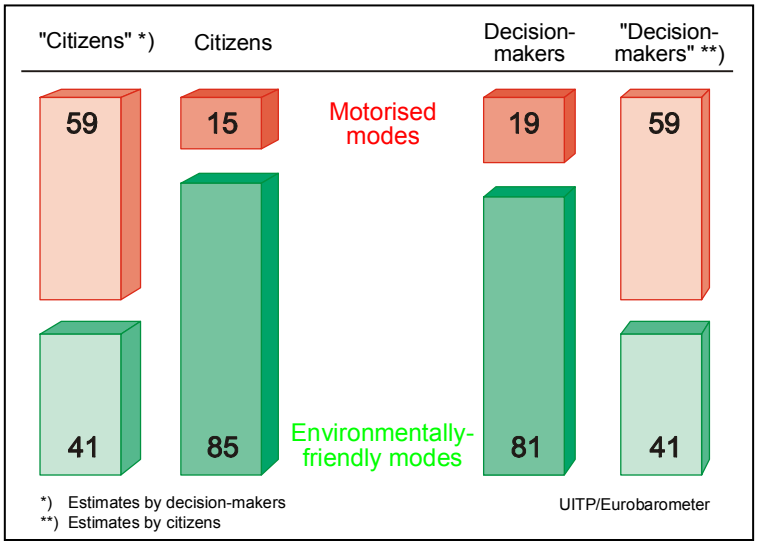
Psychological processes in car ownership and use are barriers to EST

Martin Kroon, Ministry of the Environment, The Netherlands, appealed for more research into how behaviour concerning automobile use can be changed, and into the political decision-making processes required for EST. The psychological processes involved in car ownership and use may present the largest barriers to attainment of EST. The strategies developed in the EST project for achieving EST underestimate the importance of these barriers. Current trends and the 'business-as-usual' scenarios suggest that the Car-Industrial-Cultural-Complex would not have reached its present levels of power and political and cultural influence if cars did not respond to unconscious psychological needs.

Tony Weggemans, AYIT Consulting, Tilburg, The Netherlands, questioned whether the instruments proposed for attainment of EST will change behaviour in the right direction and to the required extent. He noted that unless people are motivated to change their behaviour, the instruments could lead only to massive resistance. Government policies restricting the use of the car are not popular, and that plans to introduce road pricing in The Netherlands, in particular, have met with strong resistance over the last 10 years. Barriers to changing behaviour arise because: (i) continuation of current behaviour is psychologically more efficient than changing it; (ii) people are as inclined to change their attitudes to fit their behaviour as vice

Box 16
Motivational strategies for changing car-related behaviour ▶





Box 17
Citizens' and decision-makers' (mis)perceptions of the other's attitudes to the desirability of introducing environmentally friendly transport modes, European Union

versa; (iii) people readily produce reasons why their own behaviour should not change, as opposed to the behaviour of others; (iv) behaviour of concern is always part of an extensive pattern that can be harder to change than the targetted behaviour itself; and (v) most behaviour is extremely sensitive to social approval.

Without proper motivation, there could be massive resistance to EST

Mr. Weggemans said that a mix of motivational strategies is required, corresponding to the varied dispositions of the targetted individuals. Four examples were given, illustrated by cartoons (see Box 16): for people who think in terms of what is right and what is wrong (blue strategy); for people who like the power of the car and use it on the road (red strategy); for people who value the quality of social relations (green strategy); and for people who are inclined to make deals to achieve better mobility (orange strategy).

Marion Schädler, SocialData, Munich, Germany, presented information on the marketing of sustainable transport to individuals. She concluded that changing mobility behaviour in a sustainable direction by measures of information and awareness is a promising option for the 21st century. 'Soft' policies of information and motivation should be employed to correct negative perceptions. Among the negative perceptions are those of citizens and decision-makers of each other. Box 17 summarises data from a European Union-wide survey indicating that each group substantially underestimates the other's disposition to introduce environmentally friendly transport modes.

Changing mobility behaviour through information and awareness is a promising option

2.8. Practical examples of progress towards EST

The main exposition of practical examples of progress towards EST at the Vienna conference was associated with the *est! best*

In freight movement much can be achieved through addressing logistics issues

practices described in Section 1.4. Two of these—by **Michael Arretz** of OTTO Versand, Hamburg, and by **Johan Trouvé** of BTL Schenker Logistics, Gothenburg—also formed the basis of conference presentations. Additional examples presented during the conference sessions are described below. The key message for the movement of freight is that much can be achieved through addressing logistics issues and thereby improving efficiency of operation. The key messages for the movement of people are that much can be achieved through improved driving behaviour, through making public transport more attractive, and through the introduction of new public-private hybrid solutions that ensure access to public transport as well as to individual car use.

Gunnar Heipp, Public Transport Companies, Karlsruhe, Germany, described the highly integrated transport system in Karlsruhe. It involves regional railways that use the same tracks as light rail vehicles and trams, and also arrangements with buses, taxis, car-sharing, bicycle and pedestrian facilities, and the use of private automobiles (for travel to rural areas). There is complete integration of tariffs and a simple, low-price fare structure. Public transport has priority at intersections, waits at transport modes are kept below 10 minutes, and information about the system is widely available.

Mobility-management programs

Max Herry, Consultant, Vienna, described a mobility-management programme for five Austrian companies and government agencies. It focused on employees' work trips, company fleet management, business trips and internal transport logistics, and optimisation of business locations. Results were as follows: individual motorised travel was reduced by up to 15 per cent, public transport use increased by up to 8 per cent, bicycling increased by up to 7 per cent, and CO_2 emissions from work-related transport were reduced by 3-30 per cent. More than half of the employees of the companies and agencies rated the model project 'good' or 'very good'.

Ernst Reinhardt, Eco-Process, Zurich, described the Eco-Drive programme, which seeks to apply good driving practices to improving the environmental performance of vehicles on the road. Graduates of Eco-Drive courses on average use 11 per cent less fuel, but travel more quickly. Their driving results in less air pollution, greater ride comfort, less vehicle wear and tear, and greater safety. The payback period for investment in Eco-Drive courses is less than 18 months.

Membership in a car sharing organisation rationalises travel and reduces energy use and emissions

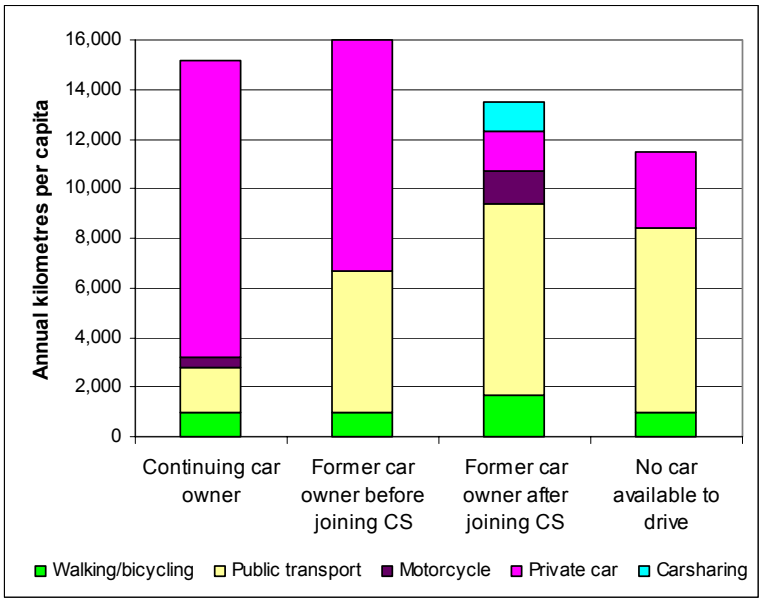
Mr. Reinhardt also presented the paper of **Sabine Ziegler** on the effects of car sharing. As illustrated in Box 18,[10] based on 511 actual and 340 potential clients of car sharing organisations, membership in a car sharing organisation reduces the amount of travel. Former car owners drive as much or more

than car owners. They borrow their neighbour's cars, drive the company car, and used rental cars or taxis. Joining a car sharing organisation rationalises their travel with easier and more clearly defined access to a car. Members move closer to the travel behaviour of people who do not have access to a car. The result is a substantial reduction in energy use and environmental impacts.

Changing driving styles to match developments in engine technology

Joop van Meel, NOVEM, The Netherlands, described 'The New Driving Force', a programme designed to change the attitudes and actions of various target groups by encouraging them to purchase and use cars, delivery vans, lorries, and buses in a more energy efficient and environmentally friendly way. At the core of the programme is a focus on changing driving styles to match developments in engine technology. Key elements include: starting the engine without touching the accelerator pedal, changing to the highest usable gear as soon as possible, and staying in the highest usable gear as long as possible. Reductions in fuel use and emissions in the order of 5-10 per cent are expected. Another element of the programme is promotion of in-car devices that provide ongoing information about environmental performance or otherwise help drivers drive in an environmentally sound manner.

Werner Ott, Postbus, Vienna, described ways of making public transport more attractive, particularly making buses attractive to early teenagers, with the aim of developing loyalty to this mode. Fifteen students were asked to design a bus. Their ideas were integrated into a bus in use. They identified with the bus and showed it off to their grandparents.



Box 18
Effects on travel of joining a car sharing organisation (CS)

2.9. Actors and their roles in achieving EST

Representatives of several key sectors including—industry, national and local governments, international organisations, NGOs, and academia—were invited to discuss their respective roles in securing progress towards EST. Summaries of their remarks follow.

Camille Blum, European Automobile Manufacturers Association, Brussels, suggested that the motor vehicle industry had made a major contribution towards attainment of EST, in term of reducing pollution. However, going beyond proposed Euro 4 new-vehicle emissions standards—e.g., an 86-97 per cent reduction from 1985 NO_x levels by 2006—would not be realistic. He said the cost would be prohibitive, and he questioned whether such low levels of emissions would be measurable. Considering all factors, he continued, transport trends are *not* unsustainable. Moreover, in some respects other sectors could provide more effective solutions.

Automotive industry is concerned about the longer term and believes present transport trends are sustainable

H.M. Lent-Philips, European Automobile Manufacturers Association, Brussels, stressed that automobile manufacturers are concerned about the longer term, i.e., beyond any short-term loss of sales. They are doing much towards sustainable transport on the technology side. However, saving energy is not fun, and something else had to be found that provides fun.

Joachim Kettner, Umweltzentrum DB AG (Environment Centre, German Railways), Berlin, made reference to Rail Agenda 21 (Bahn-A21), the railway industry's response to Agenda 21 (see Section 2.1). He stressed the need for appropriate performance benchmarks.

Peter Knoedel, BP Amoco, Germany, noted that his company's emphases with respect to transport are on cleaner fuels—including greater use of natural gas—and on fuel cells. One aim is to restore carbon to the crust of the earth indefinitely. The economics and safety of hydrogen as a fuel are issues. BP Amoco is diversifying to provide renewable energy with a view of meeting a 60-per-cent share of total energy demand in 2050. It is already the largest maker of solar modules, with production of US$180 million (20 per cent of the market) to rise soon to US$1 billion. BP Amoco's overall aim is to help move the world truly beyond petroleum to where renewable fuels are the core of the energy diet.

Denmark's initial focus on 'softer' measures —to gain support for the 'harder' measures needed for EST

Mona Mejsen, Ministry of Environment, Denmark, emphasised the roles and priorities of government actions and described her government's focus on 'softer' measures—including development of awareness of transport problems and alternatives to dominant modes—in order to gain support for the 'harder'

measures required for EST. She noted institutional and procedural barriers that hinder progress towards EST, and highlighted the need for investments into sustainable transport modes.

Bruno Oberle, Swiss Agency for the Environment, Forest and Landscape, set out Swiss priorities for the implementation of EST. He concluded that EST is feasible, that CO_2 emissions are the major long-term problem, that a combination of strategies is required, and that international commitments and cooperation will be crucial for success. He spoke to the need for an aviation fuel tax, and to the special care that must be taken to protect species' migration paths when constructing new transport infrastructure.

An aviation fuel tax is needed

Kees Plug, Ministry of Environment, The Netherlands, suggested that national governments have three primary roles in securing EST. The first is to organise appropriate processes and stimulate them. The second is to set the playing field; in The Netherlands a policy plan is formulated every four years. The third role is to act as referee, to put measures in place and sustain them. He said the EST project has provided a clear vision. He noted the value of the resulting *Guidelines*, and stressed the importance of setting clear targets and obligations.

Beatrice Schell, European Federation of Transport and Environment, Brussels, said that the EST project is a good point of departure. Her main concern is the gap between what is proposed and current policy goals that point completely in another direction. Another concern is aviation, which is almost ignored in current policy-making.

Current policy goals point away from EST

Leena Silfverberg, City of Helsinki, Finland, spoke about the roles of local governments in achieving EST, using her municipality's work as an illustration. Helsinki has a long tradition of integrated land-use and transport planning. There is a high level of acceptance of policies favouring public transport, and a high level of satisfaction with the present public transport system (75 points on a 100-point index, vs. 67 for Copenhagen, 60 for Stockholm, and 56 for Oslo). It has not been a complete success story. There have been difficulties in implementing pedestrian areas because of the dominance of motorised traffic, conflicts with less environmentally focused policies in neighbouring municipalities, and ever-present pressures for increased car dependence. A new *Land Use and Building Act* extends the rights and responsibilities of local governments and provides a comprehensive set of planning instruments for securing sustainable development, particularly by restraining further urban sprawl.

Roles of local governments in achieving EST

Roger Torode, Union Internationale des Transports Publics (UITP), Brussels, spoke to the role of public transport in

The numerous benefits of public transport

achieving EST. He noted evidence that public opinion is ready to change. He presented results of an EU-wide poll suggesting that 69 per cent of adults believe the environment is an immediate and urgent problem, and that 68 per cent say public transport should be improved to solve environmental problems associated with road traffic in urban areas. However, only 18 per cent would pay more to use public transport. He noted the numerous benefits of public transport, including lower energy use and emissions per trip, reduced social deprivation, noise, and accidents, reduced costs to users, less sprawl, more physical activity, and ready adaptation to alternative sources of energy. Much of this information, together with good practice examples, have been published in a recent UITP brochure.

2.10. Barriers to attainment of EST

The numerous barriers to progress towards EST were discussed throughout the Vienna conference. What follows are presentations made during a session devoted to this topic.

Decision-making about infrastructure is dominated by project-by-project, political considerations

Malcolm Fergusson, Institute for European Environmental Policy, London, U.K., addressed infrastructure issues in the attainment of EST. Direct environmental impacts of infrastructure development include land take and fragmentation of communities and ecosystems. Indirect impacts arise from associated spatial development patterns and induced traffic. Problems with decision-making about infrastructure include the predominance of political as opposed to environmental considerations, and treatment on a project-by-project basis rather than within a framework of spatial planning objectives. These problems are exemplified in the development of the Trans-European Networks. The result has been poor linkages among elements and between modes, and a doubtful contribution to EST. What is lacking above all is proper strategic environmental assessment of the set of proposals.

Box 19
Financing of urban public transport (UPT) within EBRD's transport portfolio

William Kennedy, European Bank for Reconstruction and Development, London, U.K., discussed financial barriers to

	Operations	Total cost (A)	EBRD financing (B)	B/A	B/total B
	Number	*Millions of euros*		*Per cent*	
Aviation	17	325.72	210.08	64%	11%
Ports	8	303.96	155.10	51%	8%
Railways	17	2,754.71	644.40	23%	33%
Roads	20	2,739.91	834.30	30%	43%
UPT	2	285.70	96.50	34%	5%
Total	6,474	8,350.38	1,942.41	23%	100%

progress towards EST. He set out the premises of EBRD's approach to transport: (i) transport systems that rely heavily on private road vehicles are not sustainable; (ii) public transport needs to have a sound financial foundation to compete in the long term with private transport; and (iii) environmental sustainability is a requirement for financial viability. He noted several constraints on making investments in public transport, including lack of creditworthy borrowers; insufficient fare revenues; lack of compensation for non-commercial services; lack of financial clarity; undue capital intensiveness; inexperience; political risk; and insufficient co-financing by environmental agencies. Overall, urban public transport is a minor part of EBRD's transport portfolio (Box 17).

Stephen Perkins, ECMT, Paris, talked about institutional barriers to progress towards EST. These would arise primarily because the proposed backcasting approach takes no account of the way markets operate, a weak point, he said, of the EST project. Backcasting ignores long-term economic uncertainties, and thus economic policy-makers could find no way of integrating such results into present policies. The barriers could be overcome if the EST approach were to speak a language common to transport, economy, finance, and spatial planning, i.e., the language of economics and markets.

Discrepancies between electoral terms and the time taken for measures to be effective

Josef Schopf, TU, Vienna, discussed transport planning barriers to progress towards EST. He argued that the primary feature of unsustainable transport is high energy consumption per trip. Growth in mobility per person, he continued, has been mostly a shift from less-energy-using to more-energy-using—and speedier—modes within approximate constancies of individual travel time. The result has been longer distances travelled, but not necessarily more access to people, goods, and services. Related to this growth is dispersion of settlements, which provides a comfortable life for planners, high profits for parts of the economy, and diminished responsibility for local politicians. The "real barriers" to attainment of EST are the discrepancy between electoral terms and the time taken for measures to be effective, the unlimited demand for comfort, the quality of transport planners, and the lack of acceptance of measures by all persons concerned.

2.11. Concluding sessions

High asthma levels in Maltese children living close to busy traffic areas

A highlight of the concluding part of the Vienna conference was a keynote speech by **Vincent Galea**, Minister of Transport for Malta, who spoke also for his cabinet colleagues the Ministers of Environment and Health. In 30 years his country had moved from having among the lowest to among the highest per capita ownership of motorised road vehicles. He emphasised the

costs of this trend particularly in relation to the health of the population. He noted, for example, the unusually high levels of asthma among children living close to busy traffic areas. Mr. Galea pledged Malta's commitment to take up the OECD's challenge to make progress towards EST.

The eastern European advantage could be rapidly eroded

Another highlight was a presentation by **Ferenc Ligetvári**, Minister of Environment, Hungary, who addressed the special challenges faced by countries of Central and Eastern Europe and the former Soviet Union. In these countries, more sustainable modes of transportation already play a much more important role in mobility than in EU countries or North America. It is an advantage that will be rapidly eroded, however, if the current shift towards car use and road freight transport continues. The trend projections show a substantial increase of CO_2 emissions, and a slight increase of NO_x emissions until 2010 and beyond. VOC and particulate emissions should decrease noticeably over the next few decades. However, the environmental criteria for an environmentally sustainable transportation system could not be achieved in the long term, notably for noise and for CO_2 emissions. The gap between projected CO_2 and NO_x emissions and the EST criteria seem to be the most serious.

The impacts on health and the environment connected to these developments will still be considerable, and noise and undesirable land use patterns will also be consequences. The latter factors have not yet been quantified due to lack of data. Health and environmental effects create high external costs. Additionally, massive investments in infrastructure need to be taken into consideration, as a substantial extension of the road infrastructure is necessary to cope with the emerging road transport volumes.

Environment Ministers of these countries have expressed concern over these trends in the Declaration "Towards Sustainable Transport in the CEI Countries".[11] The need for an environmentally-oriented transport policy is evident. As set out in the Declaration, for a successful environmental transport policy, concrete environmental targets need to be established, including quantified reduction goals for key pollutants, including CO_2, NO_x, VOCs, and particulate matter.

The EST *Guidelines* are a useful prescription for progress towards sustainable transport

Both of these speakers stressed the importance of the EST *Guidelines* as a useful prescription for progress towards sustainable transport. They endorsed the need to set targets, and to examine different packages of instruments in a comprehensive way. They noted the key role that would be played by political commitment to the *Guidelines* themselves and to policies that flow from the *Guidelines*.[12]

3. THE EST GUIDELINES

This section sets out the ten *Guidelines* for progress towards and attainment of EST endorsed at the Vienna conference. Appendix D contains a fuller exposition of the *Guidelines*.

Guideline 1.	Develop a long-term vision of a desirable transport future that is sustainable for environment and health and provides the benefits of mobility and access.	Develop a vision
Guideline 2.	Assess long-term transport trends, considering all aspects of transport, their health and environmental impacts, and the economic and social implications of continuing with 'business as usual'.	Assess transport trends
Guideline 3.	Define health and environmental quality objectives based on health and environmental criteria, standards, and sustainability requirements.	Define objectives
Guideline 4.	Set quantified, sector-specific targets derived from the environmental and health quality objectives, and set target dates and milestones.	Set quantified targets
Guideline 5.	Identify strategies to achieve EST and combinations of measures to ensure technological enhancement and changes in transport activity.	Identify strategies
Guideline 6.	Assess the social and economic implications of the vision, and ensure that they are consistent with social and economic sustainability.	Assess implications
Guideline 7.	Construct packages of measures and instruments for reaching the milestones and targets of EST. Highlight 'win-win' strategies incorporating, in particular, technology policy, infrastructure investment, pricing, transport demand and traffic management, improvement of public transport, and encouragement of walking and cycling; capture synergies (e.g., those contributing to improved road safety) and avoid counteracting effects among instruments.	Construct packages of measures
Guideline 8.	Develop an implementation plan that involves the well-phased application of packages of instruments capable of achieving EST taking into ac-	Develop an implementation plan

count local, regional, and national circumstances. Set a clear timetable and assign responsibilities for implementation. Assess whether proposed policies, plans, and programmes contribute to or counteract EST in transport and associated sectors using tools such as Strategic Environmental Assessment (SEA).

Set provisions for monitoring

Guideline 9. Set provisions for monitoring implementation and for public reporting on the EST strategy; use consistent, well-defined sustainable transport indicators to communicate the results; ensure follow-up action to adapt the strategy according to inputs received and new scientific evidence.

Build broad support and co-operation

Guideline 10. Build broad support and co-operation for implementing EST; involve concerned parties, ensure their active support and commitment, and enable broad public participation; raise public awareness and provide education programmes. Ensure that all actions are consistent with global responsibility for sustainable development.

4. CONCLUSIONS

4.1. Concerning current and projected transport activity

Among all the sectors of human activity, transport may present the greatest challenges with respect to sustainable development. The least progress has been made with respect to transport; formidable technological achievements have been offset by growth in transport activity, and by growth in the comfort, size, and power of vehicles. Moreover, achieving change in transport activity appears especially difficult, because of the convenience of and social and economic dependence on current modes.

Transport may present the greatest challenges

Progress has been made concerning **locally and regionally acting emissions**, for which there has been some unlinking or decoupling from transport activity. These emissions are declining in OECD countries, while transport activity continues to increase (see, for example, Box 2). Especially encouraging is anticipated progress in the control of emissions from diesel engines, which are more energy-efficient than petrol (gasoline) engines but, per unit of fuel consumed, produce larger amounts of nitrogen oxides and much larger amounts of carcinogenic breathable particulates.[13] However, even if this progress is realised, penetration of new technologies into vehicle fleets will take many years; meanwhile, health concerns from these emissions will continue.

Penetration of new technologies will take many years; meanwhile, health concerns from these emissions will continue

There has been no such decoupling with respect to **globally acting emissions** from transport across OECD countries—notably CO_2—which continue to increase with transport activity (again see Box 2). Other transport impacts requiring mitigation include high **noise** levels (see Box 7 and Box 11) and the **impacts of transport infrastructure**, including impacts on **biodiversity** and water drainage.

In **developing countries**, transport-related impacts of all kinds are increasing. A fundamental question, touched on only briefly at the Vienna conference, is whether the evolution in transport in developing countries could 'leap frog' over the most severely polluting phases of transport's progress in developed countries. Could transport in developing countries evolve so that the benefits of enhanced mobility for people and freight continue to outweigh the costs?

Could transport in developing countries evolve so that the benefits of enhanced mobility continue to outweigh the costs?

In many developed countries, **the benefit-cost balance appears to be reversing**; benefits have exceeded costs in the past,

but appear to do so no longer. The environmental and financial costs of urban sprawl, materials use, air and water pollution, noise, accidents, time loss through congestion, and infrastructure impacts together seem now to be more than off-setting the benefits of comfortable travel, ready access to distant places, and ready availability of products and services from those places.

People may be travelling much more to reach the same destinations

Paradoxically, the greatly heightened mobility associated with widespread motorisation and 'personalisation' of transport may not have enhanced access by an appreciable amount. People may be travelling much more to reach the same number and type of destinations (see Box 1). **The conceptual and practical distinctions between mobility and access need refinement.** The purposes of transport are more to do with access to people, places, jobs, goods, and services than with mobility, i.e., with transport activity. Indeed, rapid growth in mobility can be a barrier to access (e.g., loss of services for non-drivers). Nevertheless, assessments of transport continue to be more related to mobility than to access.

Inequity of transport in OECD countries

Several speakers mentioned the **inequity of present transport** in OECD countries, especially in respect of non-drivers, people who do not have access to a car, and women generally. Continuation of 'business as usual' could well increase the inequities.

A frequent claim made at the Vienna conference was that **transport behaviour is not well understood**. Little information is available—at least in the public domain—about the factors that determine ownership and use of motorised personal vehicles. Even less is known about the factors that lead to non-ownership and non-use when they might ordinarily have been expected. Understanding of these salient aspects of contemporary human behaviour could be essential for the development of effective strategies to change transport behaviour.

Aviation's global environmental impacts need much more attention

Several speakers said that the global environmental impacts of **aviation** need much more attention. This is the fastest growing transport sector, with environmental impacts—chiefly at high altitudes—that are much less well understood than the impacts of other modes.[14] Yet, aviation has been relatively neglected as a matter for research and policy development.

Overshadowing discussions at the Vienna conference was the question of the **future availability of affordable fossil fuels for transport**. A strong although disputed case was made that production of conventional oil—which fuels almost all transport—will inevitably begin to decline sometime during the next 20 years as the point is reached at which approximately half of all the ever-available oil has been consumed.[15] Without a corre-

sponding reduction in demand for oil there will be major price increases and local interruptions of supply. The price increases and shortages will curb demand to a degree, with corresponding reductions in transport's environmental impacts. It would be better to reduce demand for fossil fuels in advance of an anticipated shortfall in availability, thereby both avoiding the disruptions caused by sudden high prices and supply interruptions and extending the availability of this essential resource.

Reduce demand for fossil fuels before an anticipated shortfall in availability

4.2. Concerning the EST project

The EST project was welcomed as a source of ideas and as a demonstration of what could be possible. **Implementation of the EST approach was described as appropriate and necessary.** Conventional approaches to transport activity have not worked because they have not set sustainability-linked targets for the reduction of the broad range of transport's impacts. Target-setting is a prerequisite for the development of effective strategies, which must be clearly linked to the targets.

The EST project was described as being of fundamental importance. It illustrates that a target-setting approach could be feasible, and that attainment of sustainability-linked targets could produce a viable and appealing alternative to 'business as usual'.

However, it was also stated that **the EST project is only a beginning.** Much must be done to consolidate this initial work. Particular matters requiring further investigation include, among others, the EST criteria themselves—notably in respect of noise, fine and ultra-fine particles, and land use—and also resource use and the 'upstream' and 'downstream' aspects of transport activity. Attention must be given to the barriers to attainment of EST, notably social and psychological barriers, and to the social and economic implications of moving towards EST.

The EST project is only a beginning

The ***Guidelines*** **developed during the EST project** were widely considered to be especially valuable as a basis for developing a feasible and viable strategy towards sustainable development and for future-oriented policymaking and practice in the transport sector. The *Guidelines* as endorsed at the conference are set out in Section 3, and, with explanatory notes, in Appendix D.

The *Guidelines* are a valuable basis for developing a sustainable development strategy

The strongest **criticism of the EST project** made at the conference concerned the relevance of the backcasting approach to the usual discourse of government and other planners, which employs the language of economics and markets. Backcasting, it was said, ignores long-term economic uncertainties. These

points are certainly worth examination, including whether such language is prevalent and, if so, the extent to which it may be a factor in the present set of transport problems.

In defence of the backcasting approach, it could be said that it is no different in principle from goal-setting strategies that have been successful in a large number of business operations. Moreover, it builds on many features of air quality management by governments, notably the critical loads and levels concepts and targets agreed within the UNECE Convention on Long-Range Trans-boundary Air Pollution. Nevertheless, a clearer market orientation of the EST approach could be appropriate, and the private sector in its numerous forms should be involved in strategies for achieving EST.

Continuation of 'business as usual' would be unacceptable

Perhaps the strongest message that came out of the Vienna conference in support of the EST approach was that **continuation of 'business as usual' would be unacceptable**. The trajectories of current trends are alarming, present approaches are not working, and new approaches—such as those resulting from the EST project—are required.

4.3. Concerning progress towards EST

Development of indicators of progress towards EST must be a priority

The case was made that **development of useful indicators of progress towards EST must be a priority.** We can know whether progress is being achieved only to the extent we can measure progress. Where possible, indicators of progress should be based on the EST criteria, as they are refined. Thus establishment of EST criteria and targets and the development of indicators need to go hand-in-hand.

Much of the discussion at the Vienna conference concerned the **balance of technological improvements and changes in transport activity** that would be appropriate for long-term strategies for attainment of EST. Numerous viewpoints were expressed, with concern that too much emphasis would be placed on the former rather than the latter.

Endorsement of the view that the stronger contribution will come from changing transport activity

Overall, there appeared to be implicit endorsement of the position arrived at during the EST project. This was that in the long term the stronger contribution would come from changes in transport activity, particularly with respect to the movement of people (assuming that downsizing of personal vehicles is included within the category of changes in transport activity).[16] However, there were different perspectives on this point among the Member country teams involved in the EST project, as there were among participants in the conference. Moreover, the balance of effort—i.e., the contribution of different types of measure to attainment of the targets—could well change in the

course of implementation of EST. Initially, for example, more reliance could be put on gains from technology, both because there is some certainty as to what is possible and because progress of this kind is more politically acceptable. However, slow penetration of new technology into the vehicle stock leaves much room for the use of demand-side measures.

As to changes in transport activity, the **early use of 'softer' measures appeared to be favoured** by conference participants, i.e., measures that involve education and persuasion rather than fiscal instruments and regulations. This was consistent with the strategy developed during the EST project, which spoke to early focuses on information provision and attitude change as a prerequisite for changing transport activity.

Changing attitudes will be more difficult than has been anticipated in the EST project

Several cautions were raised at the conference to the effect that **changing attitudes and securing acceptance for EST will be difficult**, perhaps more difficult than has been anticipated by participants in the EST project. The project's emphasis on these matters was considered appropriate. Their importance has nevertheless been underestimated. Much more work is required on how attitudes to transport change and can be changed, and on what will be required to secure public acceptance of the need to move towards EST.

The point was made several times at the conference, often by participants in the EST project, that the **measures required for attainment of EST are for the most part already in use or planned**. What is required is that these measures be applied with greater intensity and sometimes with greater precision.

The particular rural challenges need attention

As to specific matters that may need more attention than is evident from the reports on the EST project, one was **the EST challenges of rural communities**. Transport policy-making has focused on urban challenges. This is understandable because the human impacts of transport are felt most in urban areas, and because the greatest gains may be achieved there. However, it is time to attend more to the particular rural challenges, which arise from the often greater dependence of rural communities on transport, and from the impacts of near-by inter-city transport.

Another point made strongly was that **the travelling public is not homogenous.** One large difference is between female and male attitudes and behaviour. The young and elderly can also have quite different needs from those of adult men.

Yet another point concerned the need to contain **car ownership**. Use and ownership are highly correlated, and there is accordingly as much reason to restrict one as the other. However, the disposition of policy-making is to focus on use, in part because restrictions on ownership are seen as less democratic.

Focus on creating circumstances in which car ownership is not essential

To the extent that ownership drives use, there may be good reason to focus more strongly on creating circumstances in which car ownership is not seen as essential.

Can public transport patronage be increased only by imposing restraints on personal vehicle use?

Much of the conference discussion concerned **the need for more and better public transport**, particularly public transport that could compete effectively with the high level of desirability of travel by personal vehicles. An important consideration is whether public transport patronage can be increased only by improving service and reducing fares, or whether complementary restraints on personal vehicle use are also required. Another consideration is the extent to which public transport is part of the problem or part of the solution. A driver-only bus is a greater polluter than a driver-only car. To be part of the solution, public transport must have a high level of patronage. The indirect effects of public transport must also be considered, e.g., the extent to which availability of public transport obviates car ownership and thus the large amount of discretionary travel associated with car ownership.

Low-cost measures include improvements in driving skills

Several **low-cost measures for improving the environmental performance of transport** were highlighted at the conference, notably the gains that can be achieved through improvements in driving skills. As well, there was note of the gains that could be achieved through improvements in freight logistics so that the same amount of freight could be carried in fewer vehicles.

There was much criticism at the conference **of the way in which transport planning is conducted**. Part of the solution is to require a comprehensive strategic environmental assessment of transport needs and transport proposals. In many cases, restructuring of government decision-making processes could be appropriate, so as to avoid narrow interpretations of infrastructure requirements.

International cooperation is welcomed by manufacturers because it can lead to cost-effective uniform standards

Finally of note, there was frequent reference at the Vienna conference to **the need for international cooperation** on all matters relevant to the attainment of EST. Such cooperation improves information exchange. It is welcomed by manufacturers because cost-effective uniform standards can be adopted. It allows harmonisation of importance matters such as international rail-freight operations. Above all, it can facilitate local adoption of controversial measures, on the grounds that they are part of a large collective enterprise that would bring major widespread benefits.

4.4. Concerning the next steps

Overall, there was strong endorsement of the EST approach

The Vienna conference served as a reference point for the credibility and feasibility of the approach towards attainment of EST developed during the EST project. There were some criticisms of the approach, many questions about it, and numerous suggestions as to particular points of emphasis. Overall, there was strong endorsement of the approach, particularly as exemplified in the EST *Guidelines* that were endorsed by the conference.

The conference specifically endorsed the need to set targets, to examine in a comprehensive way different packages of instruments for attaining the targets, to develop policies for implementation, and to secure political commitment for the policies. The key is policy consistency in the deployment of measures for moving towards EST.

Building on the adoption at the Vienna conference, the EST *Guidelines* were subsequently endorsed by OECD Environment Ministers at their meeting in May 2001.

The challenge now is to proceed towards implementation of EST

As well as addressing the outstanding matters raised at the Vienna conference, the challenge now is to proceed towards implementation of EST. One of the OECD's contributions to this end will be to arrange several conferences and workshops in different regions that address particular implementation challenges. These will include, for example, consideration of the roles of 'soft' measures such as education, and of how to tackle high growth rates in road freight activity and in transport activity for leisure, including tourism.

The first of these events is to be a conference entitled *Environmentally Sustainable Transport: Is Rail on Track?* to be held in Eskilstuna, Sweden, on 25-26 October, 2001.

The important roles of railways for achieving EST were highlighted throughout the EST project. Most important is the requirement that movements of passengers and freight increase by more than a factor of three by 2030 compared to today's levels. The main purpose of the Eskilstuna conference is to begin to work out how this might occur.

APPENDIX A: CONFERENCE PROGRAMME

4 October morning	**Opening and Keynote Addresses** **Environmentally Sustainable Transport (EST) - Policies for the 21st Century**
8:30	Registration
9:30	***Opening session and*** *Wilhelm Molterer, Federal Minister of Agriculture, Forestry, Environment and Water Management, Vienna.* *Thorvald Moe, Deputy Secretary-General, OECD, Paris, France* ***Welcome addresses*** *Fritz Svihalek, Executive City Councilor, City of Vienna* *George Puil, Chairman, Greater Vancouver Regional District and Translink, Vancouver*
10:00	Opening of *est! best practices* Exhibition
10:30	Break (Press Conference)
11:00	***Keynote lecture: Sustainable Development – a Huge Challenge for the Transport Sector*** *Ernst-Ulrich von Weizsäcker, MoP and President of the Wuppertal Institute for Environment, Energy and Climate, Wuppertal, Germany.*
11:30	***Keynote speeches (continued)*** *Gila Altmann, Secretary of State, Federal Ministry of Environment, Nature Protection and Reactor Safety, Germany.* *Max Friedli, Secretary of State, Federal Department of Environment, Transport, Energy and Communication, Switzerland.* *Leo Bjornskov, Deputy-Secretary of State, Ministry of Environment, Denmark.* *Rolf Annerberg, Head of Cabinet, European Commission, Brussels.* *Danuta Hübner, Executive Secretary, UNECE, Geneva.* *Frits Schlingemann, Director, Regional Office for Europe, UNEP, Geneva.*
13:00	Lunch

4 October afternoon	**Environmentally Sustainable Transport – Key Issues and Challenges**

14:30 ***Global Transport Trends and the Need for EST***

Chair: *Heinz Schreiber, Director-General, Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna.*

Panel:

- *European* Transportation Trends and Sustainability Indicators,
  Domingo Jiménez-Beltrán, Executive Director, European Environment Agency, Copenhagen.
- *Sustainable Transportation – Fuels and Land Use,*
  Jim MacKenzie, World Resources Institute, Washington, DC.
- *Air Quality Impacts from Global Motor Vehicles Emissions,*
  Michael Walsh, Consultant, Arlington, USA.
- Noise Effects from Transport, *Staffan Hygge, University of Gävle, Sweden.*

16:00 Break

16:30 ***Solutions, Instruments and Strategies for EST***

Chair: *Thorvald Moe, Deputy Secretary-General, OECD, Paris, France.*

Results from OECD's EST Project - the Concept, Approach, and Backcasting Strategies

Panel:

- From the Swedish MATs Project to the EuroEST Initiative - Goals and Strategy
  Lars Westermark, Swedish Environmental Protection Agency, Stockholm.
- Sustainable Transport Strategies in Canada,
  George Puil, Chairman, Greater Vancouver Regional District and Translink, Vancouver, Canada.
- EST Strategies for the Alpine Region,
  Alain Morcheoine, Director Air and Transport, ADEME, Paris.
- Environmental Strategies for Transport in Japan,
  Masaharu Yagishita, Director-General Environment Agency, Tokyo.
- Health Strategies for Sustainable Transport*, Carlos Dora, WHO, Rome.*

17:45 ***Presentation of Guidelines for Moving Towards EST***

18:00 Adjourn

20:00 Reception

5 October morning	**EST Scenarios – Regional Approaches, Measures and Best Practice**
9:30	***Broadening the Scope of EST – Regional Perspective for the Central and Eastern European Economies in Transition*** Chair: *Frits Schlingemann, Regional Office for Europe, UNEP, Geneva.* - Environmental Strategies for Sustainable Transport in the CEE, Kaj Bärlund, Director, Environment and Human Setttlement Division, UNECE, Geneva. - Challenges for EST in CEI Economies in Transition - Overview, Robert Thaler, Chairman CEI-Subgroup on Transport and Environment, Vienna. - EST Pilot Projects and Initiatives in Slovenia, Ales Sarec, Ministry of Environment, Slovenia. - Sustainable Urban Travel Issues in the CEE, Wojciech Suchorzewski, Chairman, OECD/ECMT Sustainable Urban Travel Project, University of Warsaw. - Sustainable Transport Initiatives in the NIS, Vadim Donchenko, Ministry of Transport, Russian Federation. - HELCOM Recommendations on Transport Infrastructure Investment Decision-Making, *Axel Friedrich*, Federal Environmental Agency, Berlin.
11:00	Break
11.30	***Broadening the Scope of the EST Concept – from National, Regional to International Scale*** Parallel Sessions with panels on lessons learned from the EST case studies ***1. Insights from the EST and related projects in Europe*** Chair: *Stefan Andersson, Swedish Environmental Protection Agency, Stockholm.* - EST Challenges for the Netherlands, *Karst Geurs, RIVM, Bilthoven.* - Sustainable Germany and EST, *Hedwig Verron, Federal Environmental Agency, Berlin.* - EST in urban areas - the Greater Oslo Area, *Harald Minken, TOI., Oslo.* - EST for the Southern Alpine Region*, Gloria Visconti, Ministry of Environment, Italy.* - EST for Austria - from regional to national scale, *Romain Molitor***,** TRAFICO, Vienna. ***2. Insights from the EST and other projects in North America and Japan*** Chair: *Marie-France Bérard, Regional Director, Environment Canada, Quebec* . - The EST Strategy for the Quebec-Windsor-Corridor in Canada, Lee Sims, IBI Group, Canada. - Transportation Fuel Projections and Scenarios for North America and Japan, Michael Landwehr, International Energy Agency, Paris. - EST for Japan, Yoshitsugu Hayashi, Chairman, National EST Committee, Nagoya University, Japan. - EST and Innovation, Richard T. Farell, Environmental Protection Agency, Washington, DC, USA. - Clean Air Initiatives, *Elizabeth J. Ashbourne, World Bank Washington, DC, USA.*
13:00	Lunch

5 October afternoon **Parallel Sessions**
Economic and Social Implications of EST, Practical Examples for EST

14:30 ***3. Economic and Cost Implications of "Business-as-usual" Trends and EST***

Chair: *Maurice Bernadet, Director, Strategic Transport Research (PREDIT), Paris.*

- Economic Implications of EST in Germany, Werner Rothengatter, IWW, University of Karlsruhe.
- Macro-economic Conditions and their Implications on Individuals, Families and Businesses, Bertrand Chateau, Director, enerdata, Grenoble.
- Transport 2010 – a long-term Investment Plan, Colin Poole, Department of the Environment, Transport and the Regions, United Kingdom.
- Economic implications of EST in Austria, Karl Steininger, University of Graz.
- Highlights from Moving the Economy, Sue Zielinski, City of Toronto.

4. Social Implications and Consumer Issues of BAU Trends and EST

Chair: *John Adams, University College, London.*

- Psychological Barriers for EST, Tony Weggemans, AYIT Consulting, Tillburg, Netherlands.
- Societal Goals for Transport, Udo Becker, TU Dresden.
- Mobility and Gender Issues, Christiane Jasper, Federal Environmental Agency, Berlin.
- Behavioural Aspects of EST, Martin Kroon, Ministry of Environment, The Hague.

5. Practical Examples of EST

Chair: *Rudolf Petersen, Wuppertal Institute, Wuppertal, Germany.*

Mobility services:

- Transport Demand Management for Companies - Pilot Projects in Austria, Max Herry, Consultant, Vienna.
- Urban and Regional Transport Networking, Gunnar Heipp, Verkehrsbetriebe Karlsruhe
- Combined Mobility Carsharing and Eco-Drive Switzerland, Ernst Reinhardt, Eco-Process / Sabine Ziegler, Mobility Carsharing, Zurich.
- Sustainable Mobility in Tourism, Peter Brandauer, Lord Mayor of Werfenweng and Representative of NETS, Austria.

Freight logistics:

- Company-wide CO2 Reduction Targets: M. Arretz, OTTO Versand, Hamburg
- Railway freight: Transport Chain Management, Johan Trouvé, Schenker Logistics, Gothenburg.
- The new Driving Style , Joop van Meel, NOVEM, Netherlands.

16:00 Break

16:30	**Actors and their Role for Achieving EST**

Chair: *Norbert Gorissen, Federal Ministry of Environment, Berlin.*

Marginal vs drastic changes for EST; regulation vs voluntary agreements and economic incentives; the role of information, education and awareness raising.

Panel:

- Integration Strategies for moving towards EST,
  Roberto Salvarani, Director, DG TREN, European Commission, Brussels.

- The role of Government in developing and implementing strategies:
- *Kees Plug, Director, Local Environmental Quality and Traffic, Ministry of Environment, Netherlands.*

- The role of municipalities for EST in Urban Areas: *Leena Silfverberg, Transport Unit, City of Helsinki, Finland.*

- The role of public transport, *Roger Torode, UITP, Brussels.*
- Regional Public transport, *Werner Ott, Postbus, Vienna.*

- WBCSD Project on Sustainable Mobility, *Peter Histon, Senior Advisor on Transport and Fuels, BP Amoco, Representative of WBCSD, Conches, Switzerland.*

17:45	***Plenary Discussion on further consideration of the Guidelines for EST***
18:00	Adjourn
20:00	Reception

6 October morning	**Implementation Strategies for EST**
9:30	***Round Table on Barriers to EST and How to Overcome them*** Chair: *Richard Gilbert, Director, Centre for Sustainable Transportation, Toronto, Canada* - Financial Barriers to EST, *William Kennedy, EBRD, London.* - Changing Mobility Behaviour: the Role of Information and Awareness Raising, *Marion Schädler, Social Data, Munich.* - Infrastructure Barriers: *Malcolm Fergusson, IEEP, London.* - Transport Planning Barriers: *Josef M. Schopf, TU Wien.* - Institutional Barriers, *Stephen Perkins, ECMT, Paris* .
11:00	Break
11:30	***Concluding Session: Stakeholder Priorities for the Implementation of EST*** ***Keynote speeches*** *Ferenc Ligetvári, Minister of Environment, Hungary* *Vincent Galea, Minister of Transport and Communication, Malta.* ***Stakeholder Roundtable*** Chair: *Jean Cinq-Mars, Environment Directorate, OECD* - Government agencies: *Mona Mejsen Westergaard, Head of Section, Danish Ministry of Environment, Copenhagen*. *Bruno Oberle, Deputy Director, Swiss Agency for the Environment, Forest and Landscape.* - Action for CEE countries, *Jan Janiga, Slovak, Ministry of Environment, Bratislava.* - Fuel industry: Transportation fuel prospects and renewables, *Peter Knoedel*, *Member of the Board, BP Amoco, Hamburg.* - Vehicle industry*: Camille Blum, Secretary-General, ACEA, Brussels.* - Transport business: Agenda 21 for the German Railways, *Joachim Kettner, Deutsche Bahn AG, Umweltzentrum, Berlin.* - Infrastructure Investment and Strategic Environmental Assessment, *Zmarak Shalizi, World Bank, Washington, DC.* - NGO's proposals: *Beatrice Schell, Director, T&E, Brussels.*
13:00	***Endorsement of Guidelines towards EST***
13:10	***Concluding Session*** ***Conference Conclusions and Follow-up Activities for the OECD*** *Jean Cinq-Mars, Head of Division, Environment Directorate OECD, Paris* *Robert Thaler, Head of Division, Federal Ministry of Agriculture, Forestry, Environment and Water Management, Vienna.*
13:30	Closure of conference

APPENDIX B: ABSTRACTS OF CONFERENCE PRESENTATIONS

INDEX OF ABSTRACTS

Available abstracts are reproduced here in the order in which corresponding papers were presented at the conference. The page numbers on which the abstracts begin in the present document are listed below by author or first author.

Presentations were also made by: Gila Altmann, Rolf Annerberg, Elizabeth Ashbourne, Kaj Bärlund, Leo Bjornskov, Camille Blum, Peter Brandauer, Vadim Donchenko, Richard Farell, Malcolm Fergusson, Max Friedli, Danuta Hübner, Domingo Jiménez-Beltrán, William Kennedy, Peter Knoedel, Harald Minken, Thorvald Moe, Wilhelm Molterer, Kees Plug, Werner Rothengatter, Roberto Salvarani, Ales Sarec, Beatrice Schell, Frits Schlingemann, Zmarak Shalizi, Fritz Svihalek, Johan Trouvé, Joop van Meel, and Masahuru Yagishita.

Sustainable Development – a Formidable Challenge for the Transport Sector
Ernst-Ulrich von Weizsäcker, MP, President, Wuppertal Institute

Sustainable development has become an imperative for the modern world. Essentially it means that not more should be consumed than is replaced by natural processes. Momentarily, the world is far from observing this imperative. We are losing some fifty to one hundred plant and animal species every day. Fish stocks are depleted at n alarming rate. And we seem to be running into irreversible climatic changes with unknown effects including, possibly, a major rise of the sea water table in the case of a partial instability of the Antarctic or Greenland ice masses. Transport is, in a sense, the most characteristic sector of unsustainable growth. Throughout modern history, the growth of transport has surpassed the growth of GDP. The reason is twofold.
Mobility has been a dream of mankind since time immemorial. Mobility symbolises both freedom and power; growth was always particularly welcome when it allowed more of this dream to be fulfilled.
The transport of goods and commodities is the key indicator of the (geographical) division of labour, which in turn stands for economic progress. Economic planners always showed a particular preoccupation for more transportation.

It was not until the 1970s that some people got worried about that ever increasing transport and mobility. The immediate causes for concern were accidents, local pollution and noise. Also, the preservation of natural habitats has played a certain role in some of the early clashes between environmentalists and the transport sector.

In OECD countries, however, those early environmental concerns have mostly vanished. Pollution levels receded, although much of that success should be attributed to pollution control in industry. Noise has not truly been diminished, but some noise walls and double windows as well as reduced noise engines have helped to reduce human exposures. Also, nature reserves have helped stabilise the situation of habitats and species in the more advanced OECD countries. On the other hand, the sheer quantitative increase of passenger cars and of lorries, of roads, of air movements and of transcontinental freight ships is eating up most of the successes of clean traffic policies.

Extrapolating transport trends into the future leads to daunting perspectives of congestion, habitat destruction and resource consumption. Where do I see scope for solutions to the dilemma? Certainly not in dictatorial restrictions. The following measures may help:
Low consumption and "zero emission" cars.
Infrastructure subsidies to environmentally acceptable public transport systems including in particular systems to switch from individual to mass transport both for people and for goods.
Traffic avoidance using electronic media (e-commerce, e-mail, distant work, videoconferences etc.)
Systematic attribution of external costs to cars, lorries and aeroplanes via taxes, charges or tradable consumption rights.

The "Factor Four-philosophy of resource efficiency can be broadly applied to the entire transport sector, as will be illustrated in the oral presentation. Examples include "hypercar", fuel cells, car sharing, electronic media, and some ideas on the interface between individual and mass transport.

The central message will be, however, that all efficiency gains will be eaten up by ever expanding consumption ("rebound effect") - unless the predominant steering instrument becomes the price (justified by the internalisation of external effects). Ecological tax reform is there to stay and to gain ever-increasing importance.

Had this thinking been applied during the 1980s, we would have much lower petrol consumption today and, consequently, much lower crude oil prices.

European transportation trends - indicators on transport and environment integration
Domingo Jiménez-Beltrán, Executive Director, European Environmental Agency, Copenhagen

An efficient, effective and flexible transport system is essential for economic activity and quality of life. People demand and expect convenient and affordable mobility for work, education and leisure. But the transport system that has evolved in the EU to meet these needs poses significant and growing threats to the environment and human health, and even defeats its own objectives ('too much traffic kills traffic').

The key to finding a balance between these seemingly opposing concerns is to develop policies that integrate environmental and other sustainability concerns into transport decision-making and related policies. Sustainability, of transport and other sectors, is now a goal for the EU under the Amsterdam Treaty – and progress is required.

'You can't manage what you can't measure'. The success of current and future integrated policies can only be judged by identifying key indicators that can be tracked and compared with concrete policy objectives (benchmarking). The Transport and Environment Reporting Mechanism (TERM) has been set up specifically for this purpose.

TERM-2000, the EEA's the first indicator-based TERM report, raises urgent sustainability concerns. The traditional approach of environmental regulation, such as setting vehicle and fuel standards, has resulted in significant improvements. But much of the gain is rapidly being outweighed by growing transport volumes, particularly private car transport and aviation, and by the introduction of heavier and more powerful vehicles. In addition to the environment and health problems linked to traffic pollution, traffic accidents continue to exact a heavy toll of deaths and injuries.

Clearly, major efforts are needed to reduce the linkage between transport and economic growth. This requires a change in policy, from the mainly supply-oriented transport policies of recent decades (focusing particularly on road transport infrastructure and car supply) towards more integrated demand-side policies designed to improve accessibility, while restricting the growth in motorised traffic. This requires, for example, better co-ordinated spatial and infrastructure planning, fair and efficient pricing, telecommunications and public education. To reach the Kyoto targets and beyond (as further reductions of greenhouse gas emissions will be needed) it is also essential to reduce substantially the use of fossil fuels in transport. This would be a win-win track, as in doing so we are also tackling other serious air-pollution problems (acid rain, urban air pollution, and eutrophication). Clear sectoral targets (environmental, transport, economic) have to be set to guide the EU transport developments in a more sustainable direction.

Sustainable Transportation – Fuels and Land Use
James J. Mackenzie, Senior Associate, World Resources Institute, Washington, DC, USA

Ground transportation practices world-wide are not sustainable for reasons of fuel resources, global warming, and increasing congestion, the result of over reliance on motor vehicles in urban areas.

Using a simple model for global conventional oil production (namely that it follows a bell-shaped pattern) and plausible estimates for ultimately recoverable crude oil, one finds that world crude oil production is likely to peak between 2010 and 2020. This means that alternative (to conventional crude oil) fuels for transportation need to be developed and adopted soon if scarcity, skyrocketing prices, and international upheaval are to be avoided beginning in the next few decades. Alternative fuels for transportation are being developed world-wide but these alternatives differ markedly in their greenhouse gas emissions. A comparison of alternatives leads one to conclude that the sustainable long-term options are battery Evs charged by renewable or non-fossil source of electricity and fuel cell Evs with the hydrogen derived from renewable or non-fossil energy sources. These two

classes of vehicles should be the focus of international efforts to introduce new transportation energy sources.

Increasing VKT (Vehicle Kilometres Travelled), the result of economic growth, and the near total emphasis on motor vehicles for mobility is leading to worldwide urban congestion. Reducing this congestion and its associated environmental impacts can only occur by providing people with alternatives to driving. These include changing land-use planning to focus on reducing the need to drive so much and introducing new transit technologies which provide more of the mobility benefits of motor vehicles. Land Use changes include encouraging mixed high-density residential, commercial, and retail development near public transit stations. The newest and most promising transit technology is Personal Rapid Transit (PRT); a system based on 4-seater, computer-operated vehicles that travel on elevated, electrified guide ways. No parking at the destination, no stopping at intermediate stations, your own personal vehicle, and access for elderly, senior citizens, and children are just a few of PRT's benefits. (For more information on PRT see web sites http://www.cprt.org/ and http://www.taxi2000.com/)

Air Quality Impacts from Global Motor Vehicle Emissions
Michael Walsh, Consultant, Arlington, USA

Continuing air quality problems from vehicle related pollution have been stimulating innovative pollution control approaches around the world. As these approaches are implemented, steady progress in reducing urban air pollution problems is occurring. An example is the experience in Southern California's Los Angeles Basin, which has had the most aggressive motor vehicle pollution control program in the world over the past forty years. From 1955 to 1993, peak ozone concentrations were cut in half. The number of days on which Federal ozone standards are exceeded fell by 50 percent from the 1976-78 time frame to the 1991-1993 interval. The average annual number of days above the Federal carbon monoxide standard fell from 30 to 4.3 during this same period and lead levels are now 98 percent lower than in the early 1970's. Most remarkably, this achievement occurred while the regional economy out-paced the national economy in total job growth, manufacturing job growth, wage levels and average household income. In short, a strong focus on environmental protection is not only compatible with strong economic development, they seem to be mutually re-enforcing.

However, the vehicle population and kilometers travelled by vehicles continues to increase, especially in the rapidly industrialising developing countries of the world. To keep pace with this growth while lowering vehicle pollution even more, the US, Europe and Japan are continuing to develop even tighter controls for coming years. Controls initially introduced in these countries are gradually also being adopted by other countries.

One response to reducing greenhouse gases has been to increase the use of highly efficient diesels in the passenger car and light truck sectors. However, these vehicles emit higher amounts of NOx and particulate matter than the gasoline fuelled alternatives and have been linked to increased cancer risks. Further, some evidence indicates that currently applied technologies which reduce the mass of PM emitted may result in an increase in the number of very small particles. Since smaller particles have the potential to be ingested more deeply into the lung than larger particles, they may actually be more hazardous. To offset both the increased cancer risk and the concern with small, ultrafine particles, particle filters will likely be used in the future. Peugeot has announced its intention to introduce such filters on certain new car models in 2000.

No country has adequately addressed the vehicle contribution to carbon dioxide emissions with the result that the fraction of global CO_2 coming from the transport sector is increasing. Europe has taken the lead with a voluntary commitment to reduce new car fuel consumption by 25% over the next decade and Japan is closely following suit. In the US there has been substantial focus on devel-

oping advanced vehicle technologies in the laboratory but in reality new car fuel economy continues to decline.

From the Swedish MATs Project to the EuroEST Initiative - Goals and Strategy
Lars Westermark, Swedish Environmental Protection Agency, Stockholm

A national EST work (1994-1996) combined the efforts of 11 stakeholders, including the auto industry and the petroleum industry. The sectoral integration process had started already in late 1980s. A key result was a common understanding on the requirements for sustainable transport. A set of objectives and targets addressing each mode of transport were agreed on. The work was performed in parallel with the work of a parliamentary committee on a new Swedish transport policy. The EST work was to a large extent taken onboard by the committee and submitted to the government. The Parliament finally agreed on a new transport policy in 1998. It included environmental targets for the transport sector. The policy is in its principles a step towards sustainable transport. The implementation of the principles proved to more difficult. International dependencies and fear for decreased competitiveness of the domestic transport sector were seen as obstacles. In response to this problem the stakeholders started the EuroEST project with the aim to promote sustainable transport in Europe.

Paving with Good Intentions: Sustainable Transport Strategies in Canada
George Puil, Chairman, Greater Vancouver Regional District and Translink, Vancouver, Canada

In the slightly more than four years since OECD's Vancouver conference, the concept of sustainability as the cornerstone for transport policy and planning has moved from the fringe to the mainstream in Canada. There is growing recognition that sustainable transport is critical to the attainment of Canada's objectives for greenhouse gas reduction, public and environmental health and economic competitiveness. While this represents an important shift of thinking in the right direction, following through with actions is a significant, as yet unmet, challenge.

The turning point in Canadian thinking about sustainability in urban transportation may have been the publication in 1993 of *A New Vision for Urban Transportation* by the Transportation Association of Canada's Urban Transportation Council. Noting that most of the trends in Canada were running in the opposite direction of sustainability, the Council proposed a generic vision encompassing land use, all modes of transport and critical related matters such as parking and finance. Many local governments and other organisations have endorsed the vision. The Council established a set of urban transportation indicators to track the progress made by Canadian cities in pursuing the vision, and surveyed the 15 largest cities to gather data on the indicators for the years 1991 and 1996. The results are interesting because they indicate the rate at which policies and realities in urban transportation are changing in Canada.

Achieving sustainable transportation represents a significant challenge for Canadian urban regions, requiring almost a complete reversal of trends that have a great deal of historical momentum. There is evidence that virtually all cities have recognised the need and begun to address it in plans and policies, but these good intentions have yet to be turned into results on the ground. These cities and their residents need significant and constructive support from provincial and federal governments to ensure a more rapid transition to a sustainable future. The result will be cities that are not only more sustainable but also more efficient, more competitive and more liveable.

EST Strategies for the Alpine Region
Alain Morcheoine, Director, Air and Transport, ADEME, Paris, France

Compared with the other OECD case studies, the Alpine case study shows two very important characteristics: i) the studied area is a mountainous area with very narrows valleys. These valleys are facing with a high density of population, a scarcity of the available land and a huge amount of transit traffic. They are subsequently a very sensitive one from an environmental point of view; ii) the alpine area is common to several countries, with rather different political organisations, cultural habits and behaviours. Compared with national case studies to carry out such a case suppose a close co-operation between the countries (four of then have participate in the study) and solve many harmonisation problems. This is the originality and the richness of this study.

Many technical problems have been raised during the study. The four most relevant are:

- To forecast the BAU level of traffic, constant elasticities of the freight traffic to the GDP are commonly used as well as for household constant trends used for increasing their motorization rate and the distance they travel daily. It raises serious problems of inconsequence due to not taking into account saturation problems like convergence of the economies of neighbouring countries or limits due to such obvious aspects as the speed of cars and the number of hour available in a day to drive it. We considered in sensitive analysis dynamic elasticity's for freight traffic/GDP and take into account saturation problem for daily km travelled for car traffic.
- What pattern of technologies have to be considered and with what dynamic of implementation. Due to the long time frame needed for an innovation to penetrate the market it raise an important backcasting problem: will we have the right technologies available in time to reach the goal. This specific aspect was taken into account. The important problem of the level of production needed for the new type of energies used and how they are produced have been also raised
- To assess economical aspects of EST, econometric tools are of no use to such far horizon as 2030 for the obvious methodological reason that this type of tools is not able to take into account important change of the economy. Other methodology is required to assess properly this aspect. We chose a qualitative assessment according different important aspects of the change.
- Due to the fact that the case involved four different countries the problem of convergence between them on the pattern of measures/instruments taken into account by the different countries, we considered this aspect as specially important compared with the other national case.

We find three main conclusions from this study:

- CO_2 is the main target and the most difficult to reach. Despite this ambitious goal of reducing CO_2 by a 80% compared with 1990, the analysis of the balance of effort characterising EST3 shows clearly that EST3 is feasible without revolution but only with a significant evolution and looks like more than today situation. BAU, at the reverse, appeared as strongly unbearable.
- The backcasting exercise on technologies shows that the planning of implementation of technologies involved is relevant with the timeframe and the actual knowledge about the dynamic of these future technologies
- The main categories of tools to be implemented to reach the goal are already existing : it is just a matter of magnitude, combination and co-ordination

To be concrete and not to much theoretical : "Alpinetree Family" saga . Another originality of this Alpine case study is given by an intend to illustrate some realistic aspects of how the daily life looks like in EST3 2030 for some common household types. The regulations and funding mechanisms underlying the painted situation are given and schemes of how the money flows and who are the winners and the losers complete the description.

Challenges for EST in CEI Economies in Transition - Overview
Robert Thaler, Chairman CEI-Subgroup on Transport and the Environment, Vienna.

Transport - and in particular access for people to communication, services and goods - has been one of the principal factors in this century's economic and social development. However, transport is also recognised as a problem sector for the numerous impacts it has on health and the environment. Present mobility patterns in passenger and freight transport do not correspond with the objectives of sustainable development. This applies also to Central and Eastern Europe, where a tremendous increase in freight transport by road and rising car traffic has been recorded in the last decade while non-motorised modes, such as walking, bicycling, public transport and rail freight transport experienced a substantial decrease.

To help address these problems, the pilot study "Environmentally Sustainable Transport in the CEI Transition Countries" was initiated by the United Nations Environment Programme (UNEP), the Organisation for Economic Co-operation and Development (OECD) and the Republic of Austria (Federal Ministry for the Environment, Youth and Family).

The CEI Sub-Group "Environment and Transport" acted as the steering committee for this project, provided guidance to the development of the study, its scope and objectives, structure and content, and supported the collection of data and background information on transport and environment in the various CEI countries. Some countries also provided examples for good practices for environmentally sound transport which are included as special information boxes in this study section.

The pilot study examines current trends in transport volume and mode choice and their likely impacts on the environment. It analyses possibilities to reduce the environmental effects of transport by modelling three different "environmentally sustainable transportation scenarios", based respectively on technological improvements, transport demand management and a combination of both. Due to problems of data availability, lack of statistics, open methodological questions and budget constraints this pilot study has to focus on the quantifiable criteria for sustainable transport, i.e. priority on emissions of carbon dioxide (CO_2), nitrogen oxides (NOx), volatile organic compounds (VOC), and particulate matter (PM). Noise and land use issues could only be described qualitatively and further work and investigations are therefore needed in this field. This is also true for the problem of fine particles as well as for the impacts of aviation on attaining or not attaining sustainable transport.

The study concludes on strategies and measures for achieving "Environmentally Sustainable Transport" (EST), taking account the specific situation in the countries in transition, and therefore, suggests a diversified approach. More details on the project findings are provided in the project brochure and the complete report entitled "Towards Sustainable Transport in the CEI Countries", OECD, UNEP, Austrian Ministry of Environment, Vienna 1999. This study provides a scientific basis for the work of the CEI Sub- Group on "Environment and Transport" to implement the "Ministerial Declaration towards Sustainable Transport in the CEI countries".

Action for CEE Countries
Ján Janiga, Senior Advisor, Ministry for the Environment, Slovak Republic.

Our national experiences with preparation process of strategic and conceptual documents solving the relation of transport and environment were based on the international conceptual documents as the Sustainable Living Strategy and Sustainable Development Conception.

The first step towards Joint Action Plan on Transport and the Environment preparation was evaluation of present situation of transport and the environment sectors and predictions on economic and social development in our country. National Report on Relation of Transport and the environment of the Slovak Republic containing these information was approved by the Government of the Slovak

Republic in 1997, after the UN - Conference of ministers of transport and the environment in Vienna.

Second step was establishment of intersectoral working group consisting of the representatives of nine ministries, statistical office, and stakeholders from local government officials, NGO and research institutes. Their task was to elaborate Joint Action Plan on Transport and Environment.

The main aim of the Action Plan is to handle mutual relations between transport and the environment in the Slovak Republic, and to ensure a future transport development direction towards increasing its sustainability.

The Action Plan consists of seven interconnected parts. It defines the basic principles, strategic trends and groups of actions ensuring improvements towards increasing sustainability in transport in the Slovak Republic. Strategic intentions and aims of transport and the environment sectors and documents adopted by the Vienna conference are reflected in the Action Plan

The Action Plan consists of two categories of actions. Within the first group short-term actions are proposed. They are factual and procedural actions such as analysis, studies, proposals of methodologies and procedures, but also elaboration of strategies and conceptions, specification of goals, setting time schedules etc. Those actions focus on assessment of current situation, defining basic goals, and in smaller scope, they focus on implementing of action with clear task definition.

The second category of actions includes medium and long-term activities aiming at solving more complex tasks or system of linked tasks, which are focused on long-term process formulation or long-term implementation of several linked actions aiming at the same goal. The actions are focused on pilot projects, specification and verification of more complicated procedures, financially and time demanding programmes. Both categories of actions are interlacing and together create a balanced Action Plan represented conceptual approach from the point of view of common long-term direction of actions towards increasing of sustainability of transport development.

Sustainable Urban Travel Issues in the CEE
Prof. Wojciech Suchorzewski, chairman, OECD/ECMT Sustainable Urban Travel Project

Presentation at the morning panel session will deal with „Sustainable Urban Travel Issues in the CEE". It will be based on the results of: (i) author's experience in formulating and advocating of sustainable transport policies for selected Polish cities (Warsaw, Lodz, Bialystok, Czestochowa), (ii) comparative studies of urban transport in other countries of the region undertaken in the framework of European Commission projects such as POSSUM and QUATTRO, (iii) participation in developing national transport policy in Poland.

As a result of a very rapid growth of motorization, in CEE cities transport problems moved to the first places in ranking of main problems. Taking into account experience of more developed countries, in several cities transport policies were adopted, which can be called sustainable. However, implementation is very slow. It shows that adoption of ambitious policy is not sufficient. This is caused, first of all, because the society as a whole is not prepared for constraints/restrictions and, consequently, policy-makers are afraid of reaction to radical measures such as reduced speed limits, parking/road charging or giving priorities to tramways and buses in urban traffic etc.

Generally, spectacular new investment projects attract more attention than more efficient but less visible options such as maintenance and modernisation of existing equipment and infrastructure and better traffic management. Financial and economic viability of competing projects and actions is not always taken into account. Poor communication between the public and policy-makers causes that even the best concepts and proposals are difficult to implement.

There are some reasons for optimism. There are no proposals to amend the policy. There are attempts to change this situation. For example, in Warsaw, "Transport Round Table" was organised as a forum for negotiation between interest groups. In addition, in the process of amending national transport policy, the following changes are considered: (i) reorientation of the whole policy to make transport more sustainable, (ii) reformulating the role of the state in solving urban transport problems. This does mean return to the old practices (in centrally planned economy the state played a paternalistic role) but providing assistance of the central government in policy formulation, research and development etc.

Sustainable Transport Initiatives in the Russian Federation
Dr. Vadim Donchenko, Research Director, the State Scientific and Research Institute of Motor Transport, Moscow, Russian Federation.

Transport is one of the most important sectors of the Russian economy. At the same time there are a number of adverse effects connected with transport activity. Every year about 30 thousand people are killed in road accidents and more than 170 thousand are injured. Emission of harmful substances from transport sector is about 13 mln tons per year (94% - from motor vehicles). In accordance with expert assessments total damage connected with transport functioning is about 8% GNP. Due to continued growth of motor fleet (about 5% per year), taking place against a background of considerable lag in development of road network, strengthening of the negative consequences of transport activity especially in big cities becomes more and more obvious. It forces both local and national authorities to take decisions and measures one way or another directed to the rise of sustainability of transport development and functioning.

Among such decisions and measures, which were adopted in Russia last years, it's possible to note:
- introduction of the system of motor vehicles certification and type approval in accordance with international requirements (ECE Regulations);
- conducting of motor vehicles periodical inspections (with the use of modern diagnostic equipment);
- toughening of demands to fuel quality and their environmental characteristics; implementation of fuel quality control at filling stations;
- introduction of obligatory environmental examination for all big transport projects;
- broadening of CNG use as a motor fuel;
- retrofit of municipal motor fleet in use by installation of catalytic converters (Moscow).

The Russian Government and Ecology Committee of the State Duma prepared a number of legislative initiatives (including proposals on tax system change) which (in case of their adoption) will give the possibility to create effective instruments for ensuring of transport sustainable development.

The main tasks, which have to be decided in Russia in the nearest prospect for ensuring of transport sustainable development, are:
- improvement of understanding the seriousness of the environmental problems connected with transport functioning by society and authority;
- ensuring of greater taking into account the safety requirements when taking the decisions in the field of transport system management at different levels; stepwise transition to realization of "sustainable transport policy";
- creation of instruments (economic, administrative) for stimulation of: production of more "clean", safe and economical vehicles; production and use of more "clean" fuels; environmentally oriented renewal of motor fleet; support of environmental performances of motor vehicles in use and so on;
- ban on sale in Russia of leaded petrol's and petrels with other unsafe additives.

Sustainable Transport Planning and Investment Strategies in the Baltic Sea Region
Axel Friedrich, Federal Environment Agency, Berlin

HELCOM (Helsinki Commission on Baltic Marine Environment Protection) Recommendation 17/1 on the "reduction of emissions from transport sector affecting the Baltic Sea" among other things, asks government and contracting parties to make environmental protection an integral part of all activities in the transport sector. In particular, it is also recommended that "international financial institutions, donors and other external sources of funding should include measures to support sustainable transport when considering financial packages for infrastructural investments." Germany has taken the lead responsibility for the process of implementing this HELCOM Recommendation. Additionally Germany has also the lead for Transport in the Baltic 21 process.

On this background and initiative of the German Umweltbundesamt the 'Project on Transport' has been developed. The project reviews trends in transport infrastructure investments in the Baltic Sea region. It investigates the decision-making process at the international financial institutions and by national governments which led to these trends and makes suggestions as to how this process could be better integrated with environmental goals aimed at the protection of the Baltic Sea.

For international lending, the project compares policies and procedures at the World Bank, the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Nordic Investment Bank (NIB), and at the EU (especially the EU PHARE Programme and the new ISPA funds). For national-level decision-making, case studies were prepared for Poland and Latvia.

Transport investments, particularly in Central and Eastern Europe, have been insufficiently focused on environmentally sustainable modes such as (commuter) rail and public transit. The prioritisation of funding for international corridors is likely to further divert resources away from necessary investment into maintenance and local and national-level infrastructures.

As a key outcome of this project, draft guidelines for better integrating environmental sustainability goals into the transportation infrastructure investment decision making process were suggested. These guidelines were presented at several workshops and HELCOM PITF meetings, where they were extensively reviewed and discussed by HELCOM member states, the European Commission, the international financial institutions and NGOs. The objective of the 'follow-up Project' was to promote the implementation of the developed draft guidelines for environmentally sustainable transportation investment decision-making in the Baltic Sea Area and to transform them into a draft HELCOM Recommendation.

EST Challenges for the Netherlands
Karst Geurs, National Institute of Public Health and the Environment, the Netherlands

Business-as-usual trends are not sustainable. The Dutch EST project and the recent Dutch National Environmental Outlook 5 show increasing CO_2 emissions and noise emissions and nuisance to be the most dominant environmental problems caused by the transport sector, where current transport policy and long-term economic scenarios are assumed. CO_2 emissions from the transport sector are expected to increase by about 60%-90% for the 1995-2030 period; especially for road freight transport and aviation strong increases are expected. Noise emissions and nuisance caused by road traffic, rail and aviation are expected to increase. By 2030 more than 80% of the Dutch population will experience noise levels above 50-dB (A) – an increase of about 25% for the 1995-2030 period. NOx, VOC and PM_{10} emissions are expected to decrease for road traffic but will increase for inland shipping, marine transport and aviation. In conclusion: business-as-usual trends are by far not sustainable according to the OECD criteria for Environmentally Sustainable Transport.

EST challenges. A trend breach in both technological development and behaviour is necessary if the EST criteria are to be realised by 2030: (i) future technological progress will have to be much

greater than in the past, e.g. new vehicle technologies such as hybrid vehicles and vehicles running on (sustainably produced) hydrogen will have to be introduced, (ii) mobility patterns must change greatly, i.e. shorter distances per trip and less reliance on motorised transport and (iii) freight transport must be different, i.e. fewer goods transported.

shorter distances with less reliance on road transport. Furthermore, changes in the spatial and economic structures at the national and international level are necessary. More goods have to be produced and consumed at a regional level. If EST is to be realised, changes outside the transport sector are necessary; e.g. a high share of sustainable produced energy.

Policy challenges. If environmentally sustainable transport is to be realised, measures will have to be taken and new instruments developed in the short term. This is mainly because of the long pre-implementation phase of transport policies, technologies that still have to be developed, and the long planning and implementation phase for land-use and infrastructure policies.

Existing policy instruments will probably not be sufficient to realise the large emission reductions envisaged by EST; innovative transport policy instruments will have to be developed and introduced. A system of tradable CO_2 permits for passenger and freight transport is probably crucial for realising EST. Other pricing instruments, regulations, land-use instruments, infrastructure policy, instruments for education and information, and instruments outside the transport sector, are important for support or facilitation of EST and for an increase in social, political and economic feasibility. The role of policy instruments in EST may be different from today: land-use policies, policies to promote non-motorised transport and telematics are not implemented to reduce travel or emissions, but to increase physical and non-physical accessibility to social and economic opportunities.

Sustainable Germany and EST
Hedwig Verron, Federal Environmental Agency, Berlin, Germany

The German Case Study to the OECD project on EST has been worked out by the Federal Environmental Agency together with the Wuppertal Institute for Climate, Environment and Energy, and the Institute for Economic Policy Research of the University of Karlsruhe.

Current trends in emissions of NO_x, VOC and particulate matters caused by transport are showing a declining pattern. Actual policy of increasing emission limits for vehicles step by step will cause these trends to proceed up to an Equivalent Zero Emission Standard if continued. For NO_x, VOC and PM the EST criteria therefore can be met without change in political strategy. Today's technology available is allowing an efficiency revolution with combustion engines. Thus alternative drives like hydrogen based fuel cells should be left for areas of application, where they can be used with higher energy efficiency than with vehicles (e. g. power plants). For cars an average fuel consumption of 2,5 litre per kilometre seems attainable by 2030.

In the EST scenario these principles of exhaust emission reduction and high efficiency vehicles will hold for all sorts of vehicles. Half of the electricity for rail traffic will stem from renewable sources.

Behavioural changes for EST will be high. There is no need to reduce mobility though. Walking and cycling will double their part, public transport will be predominant for personal travel, rail freight for goods transport.

In order to attain EST, a whole package of short and long term instruments is necessary. First of all alternative forms of mobility must become more visible, if not predominant in public space. Attractive public transport and railway systems together with mobility agencies, prevailing information and comfortably organising individual trips and goods transport, will be the basis of sustainable transport. Large scale traffic calming will give the streets back to people. The result will be a revitalisation of towns and an increase of life quality for inhabitants as well as for visitors.

Sustainability will not be gained with „pull" measures alone. Key instruments, pushing in the direction of sustainability, are emission standards for CO_2 and noise on the one hand, and fiscal instruments on the other hand. CO_2 emission standards for cars will be introduced by 2002, tightening every five years till the target of 58 g /km will be achieved. Driving costs are declining to the same amount, as fuel consumption will drop. Lowering costs would stimulate traffic growth though. Fuel tax will be applied to compensate for this effect, and also to give incentives to change modal split and trip length. To achieve the behavioural change required in the EST scenario, driving costs should double compared to 1990. For freight traffic road pricing will be used to as a steering instrument.

Sustainable transport will need low traffic land use patterns and regional economics. Housing programmes and economic subsidy programmes have to be reformed. Integrated planning must be enforced. Land take should be charged. The study shows that sustainable transport can be achieved. Some problems remain, nevertheless. While long distance freight traffic can be handled by rail and ship, for goods distribution no satisfying solution has been found. Noise levels may be lowered a good deal by speed limits and technical measures, but the noise criteria could not fully be met in the scenario. Aviation is a problem because of its very high growth rates. CO_2 emission trading for aviation companies might be a way to achieve the target.

The effects of sustainable transport policy on economy have been analysed with encouraging result. Effects generally are low. Negative outcomes may be avoided or even turned for the positive, if the process of change is cautiously started and carefully timed.

EST for the Southern Alpine Region
Gloria Visconti, Ministry of Environment Italy

Italy, as all developed Countries, is developing in the framework of transport policy a strategy that addresses negative impact of transport on the environment and health in order to promote measures for their reduction.

Giving to this objective a high importance, Italy very important to join the "Environmentally Sustainable Transport" OECD project and in particular the joint pilot study of Austria, France and Switzerland for the "Alpine Region.

The Alpine Region covered in the study represent a relevant quota of national territory, around 2151 Municipalities have been taken into account, therefore total annual demand of transport either for freight either for passenger has a big impact on environment and health. Policies and measures for an environmentally sustainable transport are urgently needed.

Concerning the results of the study, the inclusion of Italy in the project has not modified the main message provided by the three Countries: BAU scenario gives a very clear picture of unsustainable development of the transport with respect to the EST goals.

For the implementation of EST3 scenario a combination of EST1 and EST2 measures have been considered: concerning freight development (Trans alpine and inner alpine), into others the reduction of just in time, the increasing of the role of rail, new location of industry, the reduction of empty trucks traffic have been considered. For Passenger development (Trans alpine and inner alpine) the increase of car occupancy, improving of rail supply, increasing of share in public transportation.

EST Alpine project constitutes for Italy, as for the other Countries, a key tool to orient and implement efficient strategies and gives also the opportunity to develop further co-operation in defining common policies among the Countries involved.

This is the main added value of the study as only strategies defined at international level can give good results towards environmentally sustainable transport.

EST Austria – from Regional to National Scale
Romain Molitor, Trafico Transport Planning, Vienna

The study was elaborated under the umbrella of the OECD's "Environmentally Sustainable Transport (EST)" project and applies the approach EST to the country of Austria. The Business-As-Usual (BAU) Scenario shows very clearly an unsustainable development of transport in Austria with respect to EST goals. Despite the fact that important technical improvements are assumed in the BAU Scenario, the emissions of pollutants are far beyond the reduction goals required for an environmentally sustainable transportation.

This is particularly true for CO_2 where the future emissions (2030) will be 50% above 1990 level, but it basically also holds for the other pollutants (NO_x, VOC, PM) even if the gap will be smaller.

Changes in technologies alone would not be sufficient to reach sustainability, even if the very crucial issue of producing large amounts of energy without CO_2 emissions is solved: noise and land-use problems are not likely to find solutions only through technology. Similarly, transport demand management alone would result in drastic changes in the transportation system to reach EST goals so that its political and social feasibility is unlikely. Nevertheless, as shown in a combination scenario (EST 3), a feasible combination of technological breakthrough and transport management changes may contribute to reach transport sustainability in 2030 according to the EST criteria.

In EST 3 substantial increases in passenger- as well as ton-kilometres compared to 1990 still are possible, while there will be modal shifts from road and air transport to rail and water for freight and public and non-motorised transport for passengers. The economic implication of EST is a marginally slower growth rate of GDP by a mere tenth of a percent. The improvement in environmental and life quality is thus „bought" with slight decline in marketed goods and services, the only source of welfare measured by GDP. Nevertheless employment rises. In EST, unemployment has declined by 0,5%. Sectoral impacts are larger, with transport intensive industries showing output levels of up to 3% below the BAU scenario after a 20-year period, and transport extensive sectors growing faster by a comparable amount.

Ecological objectives for transport can be attained. Seen from an economic viewpoint, positive impulses can be expected due to technological efforts and new mobility services, but also improved chances for regional supply networks. Mobility chances under EST are distributed more equally and transport can be carried out in a socially more acceptable way. A change of trends from the actually not sustainable transport development with its assessable negative effects is possible. A general strategy with a synergistic combination of measures in the field of low-emission vehicle technologies, improvement of environmentally sound transport modes, mobility management with intelligent mobility services and intermodal logistics is necessary. This strategy has to be completed by the creation of fair conditions on the market and economic incentives for a sustainable mobility and economy, planning and zoning strategies

and location policies preventing urban sprawl and encouraging a mix of functions and offensive awareness building, information and public relations. The enforced co-operation not only between the provinces and communities and on a European level, but also between the sectors transport, environment, health, economy, financial and investment policy, transport and spatial planning are required. This pilot study in the framework of the OECD serves as a building stone for it.

EST Strategy to Depict the Quebec-Windsor Corridor in Canada
Lee Sims, IBI Group, Canada

As part of their contribution to the OECD Environmentally Sustainable Transportation (EST) project, Environment Canada developed strategy to meet the EST targets in the Quebec-Windsor Corridor. The Quebec-Windsor Corridor is the most densely populated area of Canada, accommodating almost half of the total national population. It is approximately 1,100km long and about 100km wide.

To achieve the EST targets, a strategy was developed of measures that included: reduced activity levels; improvements in technology; improvements in utilisation of transportation; modal shifts.

An evaluation of the potential impact on the economy was also undertaken. It indicated that implementation of EST in this corridor could have effects of reducing Gross Domestic Product (GDP) by up to 5% in the year 2030.

Some Conclusions from the IEA-Project on a Transportation Energy Outlook in the OECD until 2020

Michael Landwehr, Celine Marie-Lilliu, International Energy Agency, Paris

Some conclusions from a bottom-up model on energy demand for OECD Pacific and OECD North America are presented covering a reference scenario (base trend + enacted measures) and the 'combined policy' case (including selected additional measures which are currently under discussion). The assumptions on additional future policy measures are relatively modest. They try to reflect lead times for implementation and do not assume extremely tough targets politically difficult to implement.

For OECD Pacific (Japan + Australia + New Zealand), energy demand (and hence CO2-emissions) are expected to increase in 2020 by about 27% over 1997 in the reference scenario (incl. toprunner fuel efficiency regulation until 2010 for cars and small trucks), and by 16% in the combined policy case (demand restraint and shift measures, fuel taxation, toprunner further tightened). The energy demand growth in the reference scenario is significantly lower than in the past, partly due to lower expected economic and traffic growth but also due to already enacted policies such as the 'toprunner' programme. In the policy case, urban demand restraint policies, expanded public transport and increased fuel taxation contribute most to the savings. The combined policy case achieves only a stabilisation of energy demand after 2010.

For North America (US + Canada), energy demand growth is envisaged at +39% in 2020 over 1997 in the reference scenario (no specific measure taken into account) and at +23% (CAFE standards increase after 2005, fuel taxation[2], low-carbon fuel introduction after 2010). In the reference case, energy demand growth, though in relative terms lower than in the past, stays high, due to favourable GDP assumptions, population growth but also due to the absence of relevant energy policy initiatives. The effect of the additional policy measures is similar to those considered for Japan – a stabilisation of energy demand after 2010 could be envisaged with the package taken into account. The most important impact comes from the tightening of CAFE standard levels and the carbon tax. Including the alternative fuel substitution, the CO2 emissions levels in 2020 could be somewhat lower than in 2010 – but still much higher than today.

Which modes contribute most to future energy demand growth in the reference scenario and the savings in the combined policy case? In the past, cars and light trucks were responsible for the largest contribution to demand growth. With effective fuel efficiency regulation supported by fuel taxation (and due to slowing activity growth) a stabilisation of the energy demand (no growth) in this segment can be achieved with the measures considered (see e.g. OECD Pacific). Aviation will account for about 25% of future energy demand increases despite substantial efficiency improvements. Energy demand increases from aviation are affected but by no means stopped by the additional fuel taxation assumed. Most of the remaining energy demand increases stems from increased road freight. Up to half of the road freight energy demand increases could come from relatively

small trucks and vans (e.g. urban delivery) for which improved fuel efficiency due to toprunner/CAFE regulation is partly taken into account. The assumed fuel taxation has only a very limited influence.
In the Outlook, traffic activity increases (especially in aviation) remain the main constituent to energy demand growth. In contrast to the past, the effect of modal shifts towards less efficient modes becomes unimportant for passenger transport. This is partly due to the high modal shares already achieved by road, partly due to the decreasing differences in energy intensity between modes (even aviation!). For freight, modal shifts to road freight (in particular smaller trucks and vans) and, increasingly, aviation continues to contribute to demand growth. With the additional policies assumed, the modal shifts taking place in the reference case are little affected. Fuel intensity improvements for passenger transport come mostly from cars and light trucks (and autonomously from aviation) and depend strongly on the impact of regulatory measures. For passenger transport they could compensate for about half the effect of increased traffic activity. For freight, fuel intensity increases, while significant, compensate only for the effect of modal shift changes. Energy demand growth remains thus very similar to freight activity growth.

Conclusions: Car and light truck vehicle energy demand can be stabilised and potentially reduced in the long term beyond 2020 with continuously improving fuel intensity (regulation) and fuel taxation, which is limiting possible rebound. This is partly helped by lower traffic activity increases in the developed countries. Modal shifts towards road freight (small vans) and freight aviation continue and compensate for fuel intensity improvements in the different freight modes; For road freight and aviation, stringent demand restraint appears thus necessary to contain energy demand and CO2 emissions. Fuel intensity improvements in aviation, while the strongest compared to all other modes, compensate only a fourth of increased energy use stemming from increased aviation activity. Aviation (incl. freight and international) accounts for more than 25% of future energy demand increases.

EST for Japan
Yoshitsugu Hayashi, Chairman, National EST committee, Nagoya University, Japan

According to the forecasts by Institute of Sustainable Transport and Spatial Development of Nagoya University and EST Japan committee, total emission of carbon dioxide from transport will be increased by 40 % from 1990 till 2010 in Japan. But according to the Kyoto protocol Japan has to reduce by 6% in whole sector. It will be shown in the presentation that single measures such as modal shift from car to rail, increasing load factor and reducing vehicle-km seem almost unfeasible.

Having examined EST policies including technological advancement, capacity constraint and their mix. But even the mixed policy will increase only by 17 %.

Therefore, we have conducted policy tests of car and fuel tax reforms using a model system that was developed in our institute. We have got the results to increase only by 5% by a mix policy of annual increase of fuel tax by 2 % and spiral tax rating in car ownership tax. We have found this kind of policy mix of tax greening very effective.

A comparison of simulation results of tax reform policies in Japan and Germany using our model system will be added.

Micro-economic and Sectoral Implications on Individuals, Families and Businesses
Bertrand Chateau, ENERDATA, Grenoble, France

Evaluating specific economic impacts of EST scenarios on GDP, employment and other macroeconomic variables beyond 2015 raises very serious theoretical and methodological difficulties.

Although there is no evidence that GDP or employment should necessarily be different in BAU and EST scenarios, it is obvious that the evolution of the economic structures will not be the same in all scenarios.

In order to assess these changes in the economic structures, it is first necessary to identify which economic actors and which prices and costs categories will be affected by the policy instruments implemented in EST, and how far they will be affected. Such a qualitative assessment eventually ends up with an indication of the likely changes to expect, first in the relative growth of the economic sectors, and second in the competition conditions among transport devices and services. It also indicates possible adverse effects of the instruments as regard the attainment of EST targets, in technology and in transport demand.

To be more precise on quantitative economic consequences of the EST scenarios, while acknowledging the non accuracy of the usual economic modelling approaches in the very long term, a solution consists in describing current life and production conditions in 2030 in the EST scenario as compared to BAU, and to highlight the consequences on the budgets on the most representative categories of individuals and families, and on the turnovers of the most representative transport related businesses. The "story of the Alpinetree Family" attempts to describe in details the socio-economic conditions, which prevail in EST as compared to BAU in 2030, in relation with the policy instruments implemented. A series of micro-economic calculations relevant to this "story" helped clarifying the nature and the magnitude of the expected changes in budgets and turnovers; sectoral economic flowcharts relevant to general EST transport demand conditions, policy instruments and micro-economic calculation within the "Alpinetree story" help evaluating the size of the sectoral changes to be expected in the whole economy.

Transport 2010 – a Long-term Investment Plan
Colin Poole, Department of the Environment, Transport and the Regions, United Kingdom

The Plan, published in July 2000, has been developed within the framework of the UK's sustainable development strategy "A Better Quality of Life" published in May 1999. The Plan aims to:

- improve the reliability and efficiency of our transport system through tackling congestion, supporting economic prosperity;
- improve choice in transport for all, including those without access to a car or with poor access to public transport who may face difficulty accessing education, jobs and services;
- reduce the environmental and health impacts from transport; and
- improve transport safety and personal security.

The Plan builds on the progress already made in implementing the new approach to transport set out in the UK Government's 1998 White Paper "A New Deal for Transport: Better for Everyone". This new approach is built on the principles of *widening choice, partnership* – between central and local government and between public and private sector, and *integration* – within and between different means of transport, and with environmental, land-use, education, health and wealth creation policies.

The Plan is a long term investment plan to modernise the transport system. The Plan's scope is all surface transport in England, and railways throughout Great Britain. (Other surface transport provision in the UK is the responsibility of devolved administrations in Scotland, Wales and Northern Ireland). All modes of transport will benefit from greatly increased public and private funding totalling £180 billion (€300bn/US$260bn) over the next ten years – a 42% increase in real terms on the previous ten years. Public spending will total £132bn – a 22% increase in real terms on the previous ten years.

Modelling and analysis for the Plan identified the substantial improvements that are expected as a result of this investment and the implementation of other elements of the new approach to transport

- for example new land use planning policies, the introduction by local authorities of road user charging in a number of cities, and promotion of greater efficiency in freight distribution. The main impacts were summarised in a sustainability appraisal. The forecast impacts include:
a reduction in road congestion to below 2000 levels by 2010 (measured as the average amount of time lost per vehicle km due to actual speeds being below free-flow speeds);
a saving in carbon emissions of 1.6 million tonnes in 2010.

The Plan will deliver or contribute to a number of specific targets; for example on road congestion, UK greenhouse gas emissions, concentrations of local air pollutants, road accident casualties, and bus and rail use (both passenger and freight).

The Plan sets out the resources that will be committed to improving transport. Individual projects and programmes will follow from decisions taken by a variety of different organisations, both public and private sector. The Government will monitor closely delivery of the objectives and outcomes set out in the Plan; and review the Plan periodically.

Website address (from which publications can be downloaded): www.detr.gov.uk

Economic Impact: The example of Austria
Karl W. Steininger, Department of Economics, University of Graz, Austria

The political implementation of the EST-objective has been proven to have a number of economic impacts:

Employment. Mainly four impacts are present, with the last one mentioned being the by far dominant one:
- shift in demand for goods of economic sectors of different labour intensity;
- slight shift from unpaid self-driving to public transport with paid personnel;
- reduction in overall output (which turns out negligible, however);
- development of the real wage rate.

With respect to the last point, an EST-policy induces a price level rise, which is followed by a nominal wage rise, but lagged and not at the full amount. In any case, the environmental and noise pollution benefits outweigh this slightly slower pace of the real wage increase. A slower real wage increase causes employment to rise. The quantification for Austria gives a reduction in unemployment rate by 0.5% by 2015.

Sectoral shifts. Gains and losses, respectively, in sectoral gross output by 2015 range between 1 and 10% of their absolute level. Obviously, transport intensive sectors, such as chemical or wood processing, lose, while transport extensive production, such as electronics, gains relatively. But also in sectors with a high import share and large road transport distances in foreign trade, such as textiles and clothing, the incentive for home production rises.

Implicit transport cost. In a model, which integrates all feedback-effects, the necessary implicit transport price rise under EST is found to be by 2015: for freight transport 0.015 Euro per t and km (i.e. 0.6 Euro/km for a 40t-truck) and for passenger transport 0.09 Euro per km.

Gross domestic product. GDP growth in the Austrian case is found to slightly decrease by 2015, albeit by only 0.1% p.a., which is within the usual tolerance limit for errors.

Highlights from Moving the Economy
Sue Zielinski, City of Toronto

Moving the Economy (MTE) is an evolving and expanding partnership dedicated to promoting, attracting investment to, and creating jobs in the sustainable transportation sector in the Toronto Region and beyond.

How does MTE do this?
A) Through Information and Analysis:
- "MTE On-Line": The Internet- based international inventory of economic case studies in sustainable transportation, and one of the best sources of contacts in the field.
- The 1998 Moving the Economy Conference, and the Conference Proceedings: The conference showcased hundreds of examples of the positive contributions sustainable transportation can make to a healthy economy.
- Detour Publications: A one-stop source for the broadest selection of books, reports, magazines, and other essentials on sustainable transportation and urban ecology.

B) By Building on Success with Innovative Partnerships and Initiatives
The Sector Development Strategy: From the 200 concrete examples showcased in the Moving the Economy Conference Proceedings, a few have been selected and shaped into a Sector Development Strategy for the Toronto region. The Strategy makes the case that growing the sustainable transportation sector is a wise business investment, and it outlines two specific initiatives that together will contribute to the development of Toronto as a hub of sustainable transportation sector development.

OUR GOALS:
Planning for Sustainable Transportation
Economic Revitalization
Developing Innovative Solutions
Building on Success
Forging Creative Partnerships
Thinking Locally and Globally

Psychological Barriers for EST
Tony Weggemans, AYIT consulting, Tilburg, Netherlands

EST-instruments will no doubt effect the behaviour of individuals; but will it do so in the desired direction and with the desired size of effects? If people are not motivated intrinsically to change their behaviour, instruments will only lead to massive resistance.

Research shows that people have several (and very creative) strategies to evade the pressure of instruments which aim to change their behaviour:
- continuation of present behaviour is (psychologically) very efficient and therefore favoured;
- people are not only able to adapt their behaviour to changed attitudes, but also the other way around: to change their attitudes to let it fit their actual behaviour;
- people possess many argumentation's why, for them, it is justified *not* to change;
- behaviour is always part of a pattern, which is much harder to change than the behaviour itself;
- people are very sensitive for social approval of their behaviour and will not change if this is not socially supported;
- people use perception filters to receive and process information; we see what we want to see;
- people can accept a part of a message to justify their present behaviour with unpredicted results;
- people judge their own behaviour as more positive that of others; therefore others have to change, not they;
- if people do not feel capable to do as is wished, they won't;

- the value of freedom is (in Western societies) more central than the value of care for the environment; in value conflicts freedom will win;
- people change their behaviour more easily if they feel rewarded to do so;
- policies, which conflict with the value of freedom, lead to reactance.

Conclusions for EST-policies:
- take the emotional aspects of behaviour very seriously
- do not blame people for doing what they are doing
- Create options and freedom of choice.

What does society really want in transportation? The case of mobility vs. traffic
Udo Becker, Chair for Transportation Ecology, University of Technology Dresden

Discussions in transportation are often cumbersome: Every proposal and every measure is usually discussed controversially. This is especially true when talking about sustainable "transportation". In Agenda 21 e.g., measures to reduce transport demand are called for – but these measures are often fought fiercely. Why is this? Are some people in transportation discussions „notoriously malicious", or are different perceptions and definitions the reason for this? Maybe there are some differences in our perceptions, definitions and understandings – resulting in trouble especially when dealing with long term (sustainability-) developments. Maybe in the back of our minds we follow different objective functions: Maybe the basis for all our discussions is not as clear as we think it is. In our societies, it seems like different understandings of certain words and, consequently, different objective functions exist. Then, however, it is small wonder that we often engage in furious and futile battles.

This contribution tries to develop a certain understanding of transportation in general and of mobility and traffic in particular. The understanding is based on the fact that humans have certain needs, not all of them can be satisfied at home (it should be noted that „needs" is the key word of the Brundtland–definition for sustainability). Whenever a person wants to or has to move (or, for this purpose, some goods have to be moved), a special need is derived which we call "Mobility" (this is sometimes called access" or accessibility). Mobility is, accordingly, whenever somebody realizes transport, whenever somebody moves.

All „mobility" has to use some tools in order to be realised: Vehicles, traffic infrastructures, traffic laws, traffic police and other things are necessary for movements. The instruments used for mobility is then called „Traffic". Traffic is the system of all instruments in transportation. Traffic and mobility are, then, to be seen as two sides of one medal: The side called mobility comes into focus, when needs, when activities or trip chains are to be considered, the side called traffic comes into focus, when engineering aspects are to be concentrated on. It follows:

The objective of all our actions within transportation is to satisfy mobility. We have to bring people to destinations, we have to deliver mobility. In order to deliver mobility, we have to use our instruments in a certain way: We have to develop the solution, which allows for mobility with the least costs, with the least number of accidents, with the least fuel consumption, the least noise, the least pollution, the least waste, the least land consumption, the least .... with the least traffic. First, we have to develop measures and systems which allow for mobility (for all parts of the population). Then, when we have to decide between different solutions providing the same level of mobility, we have to minimize the amount of traffic needed: Mobility for all with least traffic.

The application of these terms allows to identify measures which are „efficient". Efficiency is the key in our societies. Efficiency in transportation may be seen as the fraction between „mobility" and „traffic": There are solutions which increase mobility and keep the level of traffic constant, or solutions which keep the level of mobility constant but change the amount of traffic, and there are solutions which change both (which may very well be the rule). We define:

Efficiency = (Mobility provided to the population) / (Traffic necessary)

Here, the term „traffic“ comprises all resources and „costs“ of transportation, and „mobility“ comprises all mobility aspects of all parts of the population.

Gender and Mobility Issues
Christiane Jasper, Federal Environmental Agency, Berlin

In the 1999 Treaty of Amsterdam (Articles 2 and 3), the European Union adopted gender mainstreaming as a principle for all policy fields of the EU. Put simply, gender mainstreaming means that decision-making processes are to be geared to equality between (equal opportunities for) men and women, in all fields and at all levels. Equality between men and women has thus been defined as a common task and advanced to the mainstream level, i.e. become a mandatory principle for all those involved in policy-making.

Applied to mobility, this means the need to acknowledge, and take into account in transport policy, that women and men are not a homogeneous group but have different needs, responsibilities, and modes of behaviour.

The benefits and burdens of car-based mobility are still unevenly distributed. In addition to children and the elderly, those who lose out are mainly women, because

- in order to carry out their day-to-day responsibilities such as jobs, shopping, taking care of their children, etc., they need to combine a variety of local trips for which the car is not the optimal means of transport;
- streets have lost their function as a place to spend time and communicate with others;
- children have, for the same reason, considerably fewer areas where they can play; as a result, their mothers have to invest more time supervising and accompanying them;
- with pedestrians being crowded out of public spaces, women are or perceive themselves to be at greater risk of being exposed to violence;
- women are disproportionately likely to be the victims of traffic accidents;
- due to financial limitations they are less likely to have a car, which, however, gives them much experience with ‘carless’ mobility.

When it comes to mobility, women are an ecological avant-garde whose predominantly carless mobility could serve as a model for concepts aimed at reducing transport demand. Conventional transport planning and policies, by contrast, improve auto-mobility rather than ensuring car-free mobility. In addition, men have a specific, irrational dependence on the car. They tend to glorify technology and high speed, and to associate the automobile with an ideology of freedom. All this has unmanageable ecological and social consequences.

Without the active participation of women and the incorporation of women’s perspective at all levels of decision-making, the goal of sustainable mobility cannot be achieved.

Behavioural Aspects of EST
Martin Kroon, Ministry of the Environment, Netherlands

EST implies far-reaching and radical changes in mobility and consumer behaviour, travel patterns and lifestyle as well as radical changes in vehicle technology and production patterns.

The conditions that can effectively influence neither behaviour change, nor the political decision processes for implementing the EST policy instruments have been researched in full depth.

Reductions of over 50% of total automobility [car ownership and car use] are unprecedented phenomena in democratic market economies - apart from wartime conditions. Assessment of the behavioural instruments necessary for re-mapping people minds about car ownership, car use and car characteristics are urgently needed. EST without a behavioural implementation assessment scenario is like a bicycle without pedals.

The love for the automobile [ref. Wolfgang Sachs] is at the heart of the mobility-and-environment-problems. Based on Sachs' analysis and on the work of Centre for Environmental and Traffic Psychology of Groningen University [Vlek, Steg c.s.]One must conclude that EST highly underestimates the relevance and role of the *affective motives* for car ownership and car use as the largest barrier for EST and behaviour change. On the other hand, BAU trends are triggered and pushed forward by the same (auto) mobility supporting mental map, which can be identified through research of these affective motives.

Such motives reach out much further than the simple schemes of freedom and status. Why and how can an industrial product - unrivalled, compared to other machines - raise so much affection, emotion [and when threatened: aggression] money spending or legal and political tolerance for the mass killing - globally - of

About a million people each year? The answer is that cars are the modern slaves that make men the master, that fit perfectly into our nomad and chivalrous genes and that serve our desire for power. Cars offer a moving territory, they communicate our wish-to-be ego's and (sub) personalities, they give social bonds and narcotic levels of speed and risk perception, but also serve as a metal womb and friend [ref. Diekstra].

Indeed, the *transport function* of cars is at the basis of the car system and popularity. The larger part of car use [about two third] reflects its utility as an efficient individual means of transport. The other part of ownership and use can best be understood through analysis of the affective motives, which as such reinforce the transportation function. These have made the car a *vehicle of happiness*, which coincides with overkill effect such as: exclusive car mobility patterns and habits [including car addiction and mental captivity] and irrational driver behaviour. The key problem of these motives for sustainability is their role in car design, car marketing, pollution, road safety and VMT/energy spilling. If cars were to be designed as purely rational and highly efficient means of transport from A to B, then the 1 litre/100 km car would be the natural vehicle between public transport and bicycles as the dominant A to B's. Identification of man and machine would be as absent as it is between man and PC or TV.

Today's practise and the BAU scenario show the power of the *Car-Industrial-Cultural-Complex*, which could never have come to the levels of power and political and cultural influence if cars did not respond to these unconscious psychological needs. Without the affective role of the car half of the car manufacturers would already have been out of business. Since the vehicle/transportation and oil business is the larger part of the top 10 of global industry and the largest industrial and service sector in most OECD countries, the recent diesel barricades reflect just a tiny glimpse of the behaviour and political barriers to EST.

Transport Demand Management for Companies – Pilot Projects in Austria
Max Herry, Max Herry Consulting, Vienna

Under the auspices of a two-year model project initiated by the Federal Ministry for Agriculture and Forestry, the Environment and the Water Economy together with the Chamber for Business and Industry, the Vorarlberg Media Office was one of the first companies to put a "workplace mobility management" into practice. The Federal Ministry provided technical and financial support, and the Institute for Transport Planning and Traffic Engineering, TU-Vienna, acted as external consultant.

Environmentally friendly mobility is a subject, which has long been of burning interest in the Vorarlberg Media office. But when the office moved from Bregenz to Schwarzach in 1996, the local situation was quite different. The new office building was out in the greenfields slightly off the beaten track. This was not the most convenient of locations from a traffic planning point of view. Furthermore, the move from Bregenz to Schwarzach meant that now only 7 % of the staff lived locally. Indeed, this amongst a host of other considerations – not the least of which was the ready availability of adequate parking space – was enough to convince most of the office staff that the best way to come to work was by car. This prompted a group of five environmental enthusiasts and representatives management to initiate a campaign to optimise the mobility habits of all members of staff.

These efforts culminated in the company's participation in the government-sponsored model project "*[environmentally] Gentle Mobility Partnership"*. The initial reaction to this model project – which was launched in 1997 – was one of almost complete disinterest. But sheer persistence on the part of the campaigners overcame this general apathy and ushered in a gratifying trend. The percentage of employees who drove to work each day dropped from 73% down to 60%. Within the space of two years, the CO_2 emissions attributable to travel to and from work were reduced by as much as 17% thanks to the various measures implemented. At the end of the project no fewer than 76% of the office employees were of the opinion that the project had heightened awareness of the need for more environmentally sound forms of mobility Meanwhile, opinion leaders at the Vorarlberg Media office consider it highly worthwhile and desirable that other companies should follow this example.

Integrated Public Transport Systems- The example of Karlsruhe.
Gunnar Heipp, Planning Department, Public Transport Companies, Karlsruhe, Germany.

If public transport as a world wide accepted solution to sustainable mass transportation in urban areas wants to succeed, a wide range of complementary means to the pure transportation matter must be studied to attract more users.

The Karlsruhe integrated public transport system takes in account at least the following aspects: A well integrated network among Railways, Light Rail, Urban Tramways, Buses, Taxis, Car-sharing, Bicycles, Pedestrians and the use of private automobiles. Agglomeration and the rural areas are connected excellently.

Aiming to get more customers on public transport, the best possible co-ordination between land use and the transportation network is demanded. The Karlsruhe region has worked effectively in that way. At the same time, the city owned local public transport providers have adapted the old-fashioned railway network to make up the fast urban development of the car-optimised structures of the 60s and 70s. Bike+Ride and Park+Ride are important accompanying offers.

Attaining the same simplicity as car-drivers find when using their car to get from A to B is a major key point in changing deeply rooted habits. A competitive solution to individual mobility has been created in Karlsruhe: a complete integration of tariffs, an easy-to-understand pricing system, special offers for all sorts of travel purposes and ticket prices, that are among the cheapest in Germany permitting at the same time one of the lowest subvention rates.

Public transport has many places been reduced to the needs of commuters and pupils. The responsible authorities in Karlsruhe are trying harder since two decades to make trams and buses easy to like and use, also late in the evening, on weekends and through the night.

Passengers travel faster since traffic lights are most of the time on green for trams. On parallel, timetables and infrastructure have been made in a way, that changing from one means to another is a matter of not more than 5-10 minutes even in rural areas. Service and property have been improved steadily.

Information on before hand is deciding often, if potential customers use their car or switch over to public or combined transport solutions. Internet, intensive press work and the entire staff are involved in giving the right information in Karlsruhe.

Future stress of activities will be e.g. the creation of a mobility point to offer solutions for all kind of transportation and travel matters, new services via Internet, luggage services, bicycle rental, new combined offers for all kind of events and more service at stations and stops.

CarSharing – plus, Switzerland
Sabine Ziegler, Mobility Carsharing, Switzerland.

Mobility CarSharing is based on a simple yet powerful premise: people don't necessarily want cars, they want the mobility that cars provide. Based on this idea, Mobility CarSharing has become the world leader in providing integrated mobility services to its customers throughout Switzerland. Based around a core package of services that allows customers to quickly, easily and flexibly hire cars on a short-, medium- or long-term basis, Mobility CarSharing has sought to offer a wide choice of mobility options to its customers through new partnerships with public transport and rail operators. Mobility CarSharing customers no longer face the dilemma of having to purchase a car or do without its flexibility -- rather, they can use a car when it most suits their needs and use other, less polluting, forms of transport when these are more convenient. Indeed carsharing does not hinder or infringe peoples' mobility behaviour, it makes it more flexible and adds value to the user, the environment and the society in general.

Examples of Mobility CarSharing services include:
- Combined transit – carsharing passes (collaboration with the national railway SBB – CFF, regional products such as züri mobil in the Greater Zurich Area)
- Collaboration with Car rental schemes (Hertz and Eurocar) for supplementary offers at holiday peaks)
- Collaboration with nation-wide retailers (Migros) with offers for businesses and van rentals in shopping centres.
- Collaboration with Migros to acquire the most ecological serial vehicle on the market 75 VW Lupos 3 TDL

Mobility CarSharing allows clients to reduce the environmental impact of their travel patterns. After becoming users of Mobility CarSharing's services, customers display the following characteristics:
- Short trips (less than 5 km) are rationalised and other environmentally sound mobility means are taken (by foot, bike or moped).
- Vehicle occupancy is higher (Mobility occupancy = 2,1 persons; average Swiss occupancy = 1,3 persons).
- A drastic shift in the modal split of the users is seen (average Swiss share for public transport: 20% and 80% for car; while 75% of Mobility CarSharing members use public transport and 25% car resulting in a decrease of transport energy consumption of 57%)

A detailed life cycle assessment (LCA) of Mobility CarSharing services has recorded an overall reduction in environmental impacts of 20% despite an only 3% drop in distances travelled. The assessment methodology is being further developed to include noise pollution, fine particulate matter and social impacts (accidents) beyond the current focus on air emissions, energy use and major soil and water pollutants. This tool will be used in-house as a strategic tool to document our emissions on an annual basis.

Mobility CarSharing Switzerland is a co-operative society, registered in Zurich with headquarters in Lucerne and offices in Geneva and Zurich. It operates within Switzerland and provides over 1,400 vehicles of 14 different categories and types at approximately 800 locations (250 at train stations) to its over 36,000 customers. Over the last four years, Mobility CarSharing registered an annual growth of 8,000 customers.

Eco-Drive Switzerland
Ernst Reinhardt, Eco-process, Zurich, Switzerland

… Sets technical Eco-Drive® standards
… Certifies course providers, courses and instructors
… Runs a documented quality management

It has an exclusive, targeted mandate of the Swiss Federal Office of Energy – proprietor of the trademark Eco-Drive® – to promote the Eco-Drive® driving technique in supporting training institutions, trainers and trainees; To contribute to road safety and sustainable transport.

An alliance of all Swiss automobile associations, road safety boards, Swiss Army transports wing, POST, Association of driving experts etc.

Training imparted to date: > 50 000
An evaluation and environmental audit in 2000 has established:
Eco-Drivers use 11% less fuel – and get around more quickly.
Eco-Drive® reduces air-pollution.
Greater ride comfort, less vehicle wear and tear.
Eco-Drive® is economical: payback less than 1.5 years.
Eco-Drive® improves road safety.

Company-wide CO_2 reductions through Green Supply Chain Management Otto
Michael Arretz, OTTO Versand, Hamburg

In 1993, the international procurement of goods and materials for the German mail-order retailer Otto's product lines caused more than 184,000 tonnes of CO_2 emissions. To lower these CO_2 emissions, Otto developed a four-pronged strategy. Beside testing and using alternative fuels to establish low or zero emission systems, the main aim has been to optimise transportation technically and logistically and to shift consignments to other means of transport. From 1993 to 1999, annual CO_2 emissions were reduced by some 40% thanks to a large number of measures. By 1999, CO_2 emissions from the international transportation of incoming goods had thus been reduced to 104,000 tonnes per year. At the same time, the eco-efficiency factors for incoming goods transport were raised from 0.45 tonnes of merchandise per tonne of CO_2 emissions to 0.78.

One central element of the Green Supply Chain Management project involves shifting consignments from high-emission means of transport such as planes and trucks to lower-emission means of transport such as sea-going ships. This means that new logistics chains have to be established.

For the Turkish market, some 5% of consignments were transferred from truck to ship. This led to a saving of 0.16 tonnes of CO_2 and DM 300.00 per tonne of merchandise. At the same time, handling was greatly simplified. In 2000 the share of sea going ship transportation should be increased to 20%.

For the Hong Kong market a total of 8% of pure air consignments were shifted to combined sea-air transportation. As a result, CO_2 emissions were cut by 2.8 tonnes and costs by DM 1,800.00 per tonne of merchandise. In 2000 the share of sea-air transportation should be increased to 12%.

The measures clearly show that, even in times of "just in time" and "quick response", a reduction in emissions, handling effort and transport costs can be achieved by the establishment of new logistics chains and the use of low-energy and low-emission means of transport such as sea-going ships.

The Role of Municipalities for EST in Urban Areas
Leena Silfverberg, Ministry of the Environment Finland

Never a completed plan but a continuing learning process
A coherent transport policy for decades. Since the late sixties, traffic policy in Helsinki has favoured public transport. The need for public transport based policy emerged when an extensive, highway based transport plan was prepared and presented to the decision-makers. It's negative impacts on the environment and infrastructures were obvious. The plan was rejected, and in 1969 politicians decided to build an underground system. The policy has worked efficiently in practise: even nowadays 69 % of commuters to the city centre travel by bus, local train, underground or tram. Traffic jams in the centre of this metropolitan area of 1.2 million inhabitants are rare.

Long tradition of integrated land use and transport planning. Helsinki City Planning Department was set up in 1964 to assume responsibility for master planning and detailed planning of land use and transportation. The Department's task is to create the basis for Helsinki's development as a functional, healthy, safe and beautiful city. Thus, the city has been built in a controlled and planned way. The public transport system is operated by the city. Besides providing effective public transport, the city has restrained the use of private cars by limiting the number of parking places and by regulating parking fees. The cycling network is quite extensive, too: there is a total of 900 kilometres of cycle paths.

High acceptance of the chosen policy. According to surveys, public opinion strongly supports the city's transport policy. The great majority of inhabitants (90 per cent) think that the city should continue to favour public transport. A citizen benchmarking survey recently undertaken in Helsinki, Copenhagen, Stockholm and Oslo showed Helsinki to have the best citizen satisfaction index. There were top scores in most of the separate indicators, relating to traffic supply, reliability, social benefit, and value for money and loyalty of public transport. The principle of taking care of safety and the needs of various populations groups, such as children, the elderly and disabled, are also generally accepted.

Not a completed success story, though...
In spite of efforts made, planning and implementation of pedestrian areas in Helsinki is difficult. The city lacks a medieval centre, and it appears impossible to keep car traffic away even from the few pedestrianised streets without building huge tunnel systems for cars. Presently, the only way to avoid the dominance of motorised traffic and to improve the city atmosphere is to make the different modes co-exist peacefully using the same street space.

The biggest environmental problem in the whole metropolitan area is urban sprawl. Because of dispersed socio-economic development car dependence and the volume of private car traffic tend to increase. Change would require a joint effort by all of the neighbouring municipalities and by sev-

eral administrative sectors. Public transport, walking and cycling need new innovative measures to maintain or increase their share.

Finnish municipalities have extensive rights to decide on their own spatial planning. According to the new Land Use and Building Act, which came into force at the beginning of the year 2000, the rights of local authorities have been further extended. Increased rights lead to more responsibilities concerning the planning system, it's results and it's effects.

The new Act provides a comprehensive set of planning instruments for securing sustainable development by, for example, preventing urban sprawl, improving environmentally sustainable transport and keeping inner cities liveable.

Needed: Citizen participation, transparency and interaction
The new planning system is wide open to public participation, not only with land owners but with all individuals and institutions whose living and working conditions may be affected by the plan. Occupiers are regarded as the best experts in assessing their own living and working environment.

What the city needs, are no more great visionaries but effective co-operation. The planner has to pay high regard to the roles and inputs of other stakeholders, awareness of the comprehensive of the task, understanding of its complexity and caring about effects. This requires courage and humility at the same time. Instead of authoritative regimes the city transport system should be planned by a team with different viewpoints, expertise and instruments - like a music band, where playing solo is possible only with the help and support of the others.

The role of Public Transport
Roger Torode, UITP, Brussels

We are not achieving sustainable mobility because present transport arrangements do not give mobility to all, and because increasing traffic has many damaging effects, including accidents, air and noise pollution, adverse social impacts and a reduction in physical exercise. These problems are not being solved, they are getting worse, and traffic is now preventing our cities from fulfilling their purpose as generators of human activity and enterprise.

The challenge we face is to find more effective ways of providing mobility, so that all the community can lead full and active lives. We need to transfer journeys from the car to public transport, walking and cycling; to reinvent safe, attractive streets in which it is normal for children to walk or cycle to school; to use land-use planning to reduce the length of journeys; and to look for ways of participating in social activities that generate less traffic. This requires action that must include enhancements to public transport. The benefits would accrue to the whole community.

Public transport has a strong role to play in achieving sustainable mobility. Measures to promote public transport and reduce car use will have multiple benefits. For example:

- Greater use of public transport will reduce energy consumed and greenhouse gas emissions per journey, enhance the service public transport can offer and reduce social deprivation.
- A reduction in traffic will also improve air quality and reduce accidents.
- Public transport uses less land than private transport. As a result, it helps to avoid urban sprawl and enables further savings in energy consumption.
- Public transport can help to reduce traffic speeds. Enforcement of speed limits will reduce emissions and accidents, and create a safer environment for pedestrians and cyclists.
- Public transport encourages people to walk and cycle for part of their journeys, which will promote health by providing physical activity, while decreasing noise and air pollution.
- Electrically powered public transport can easily adapt to alternative sources of energy that are renewable and less polluting. It also causes less noise than petrol or diesel vehicles.
- Public transport can be cheaper overall in terms of total annual expenditure on travel.

Good examples are available of successful public transport initiatives, which will contribute to a sustainable transport network. A particular action of the European Commission has been to develop systems of benchmarking and information to improve knowledge of best practice in the public transport industry in Europe and throughout the world. These comparisons highlight major performance differences between cities and operators within the transport sector. This shows that there is great potential for improvement in the quality, performance and efficiency of public transport operations, and points to how such improvements may be achieved.

UITP has called on governments to introduce a range of measures including:

- Facilitating investment in high quality, energy-efficient public transport.
- Encouraging integrated planning of land use and transport in order to reduce overall travel demand whilst encouraging walking, cycling and public transport, and reducing the need to travel by car.
- Promoting traffic management and parking policies that will encourage public transport use and provide road conditions in which buses and trams can operate efficiently.
- Making balanced decisions, which take full account of all environmental and social effects, including noise and accidents, as well as effects on the economy such as land costs and access to employment.
- Ensuring that these effects are reflected as far as possible in the charges to the user for different modes.
- Agreeing funding measures to assist developing countries in public transport improvements.

Public transport has a strong role to play in achieving sustainable mobility, and encouraging examples of good practice exist throughout the world. We can move decisively towards this goal by adopting these practices more widely. However, this requires strong action at international, national and local levels of government. Our long-term vision is to achieve transport, which is sustainable for health, and the environment, which meets the needs of the present without endangering the ability of future generations to meet theirs – this will give us sustainable mobility.

Sustainable Mobility -A World Business Council for Sustainable Development Member-led Project, initiated by a group of leading companies

Peter Histon, Advisor on Transport and Fuels, BP Amoco, Representing WBCSD, Conches, Switzerland

This is a WBCSD member-led initiative to assess the global impacts of current transportation modes (land, sea and air) and to develop a vision of future mobility. The Project aims to provide a strategic direction for the diversified industries associated with mobility creating ideas for next-generation systems, which address societal, environmental and economic concerns.

What makes this Project different from previous analyses is that the initiative lies with industry itself through companies, which will need to be at the forefront of sustained mobility development. Though major auto and energy companies are taking the lead, the Project is not about determining individual technical or commercial responses. It is much more about direction, policy and options for change, and it will be approached from a global perspective since the challenges are global and solutions depend on co-operation between government, business and civil society. The key challenges to be addressed may include: technological advances, emissions, fuel efficiency, climate change, urban planning, roads, public transportation, resource use and conservation, safety, public health, employment, knowledge and government policies.

The Project aims to outline a clear vision of mobility for the future, a vision that takes into account the access needs of the developing world, of population increases and the necessity of economic growth in poor countries, while ensuring that transportation's contribution to that growth is sustainable. Assessing both the positive and negative impacts of land, sea and air links, and examining

whether they are sustainable, and if not, how they might be made so, are vital to shaping the overall vision.

Over a three-year period, the work program will progress through various stages. The first is the commissioning of a *'Mobility 2000'* status Report. The second comprises a *'Scoping' Study,* which will build upon the previous report as well as on other independent studies to give a vital framework for the third and final step. This is the main '*Sustainable Mobility 2030' Report,* to be released by mid-2003.

Nine companies - BP, DaimlerChrysler, Ford, GM, Michelin, Norsk Hydro, Shell, Toyota and Volkswagen - have formed a Core Member Group Steering Committee for the Project to develop policies, principles and the framework to achieve the project objectives and to ensure that the project maintains its overall direction, quality and progress within the agreed timeframe. A sponsor group of other interested companies and bodies plays a support role, and an assurance group of eminent individuals and experts, provides a balance of view.

The main report, 'Sustainable Mobility 2030', will have a target release date of mid 2003, with an interim report ready for the Rio+10 event (Fall 2002).

Changing Mobility Behaviour – the Role of Information and Awareness Raising –
Marion Schädler, Socialdata, Institut für Verkehrs- und Infrastrukturforschung GmbH, München / Germany

In the 20th century the increase in car traffic has become one of the greatest problems for our cities. Both, citizens and political decision-makers agree that there is a need for relieving measures. Those measures could be "hard" policies (infrastructure, technology) as well as "soft" policies (information, communication). In general, infrastructural / technical measures are important, but they are also expensive, often spatially limited or over-estimated in their effectiveness. Moreover, restrictive measures on car traffic are often seen in a very critical way by citizens.

Consequently, "soft" policies are an effective tool to reach the aim of reducing car traffic in a faster, cheaper and "smoother" way. In addition, these measures could change peoples' behaviour on a voluntary basis. This approach seems to be rewarding, as there is plenty of evidence that subjective views of the people are incomplete and distorted, but they nevertheless determine (mobility) behaviour. Thus, in order to encourage the use of environmentally friendly modes, "soft" policies of information and motivation must be employed to "correct" the negative perceptions and to give appropriate information.

The efficiency of those measures is still doubted, mainly by engineers and transport officials, but in the meantime a lot of projects have proven that soft policies – applied in a proper way – do work:

- A study on assessments of mobility in the European Union, sponsored by the UITP, reveals very similar results in all European countries and peoples' feelings for the need for a change in traffic planning / policy.
- The European Commission's INPHORMM-project has come up with broad evidence that awareness, information and marketing programmes can provide a substantial contribution for a change towards environmentally-friendly modes.
- An UITP-project in 13 different European countries has shown that soft policies do work in all those countries, no matter how different the preconditions might be.
- large application-projects in Germany, Austria, Switzerland and Sweden show that appropriate marketing techniques can be successfully applied on a large scale, in short terms, and they can work very cost-effective.
- Projects in Viernheim (Germany) and Perth (Australia) show that this approach can be applied for increasing the use of all environmentally-friendly modes.

- Cost-/benefit-analyses (e.g. Perth) show that soft policies are extremely cost-effective and are a very efficient investment.

In summary, there is much evidence that changing mobility behaviour by measures of information and awareness in a sustainable way is a promising perspective for the 21st century.

Transport Planning Barriers to EST
Josef Michael Schopf, University of Technology, Vienna

What is *not* environmentally sustainable transport?
Energy-consumption is a good parameter to show who is a risk to EST. If we look at the energy-consumption of each transport mode for a typical single trip ("system") we have a ratio of
Pedestrians, cycling = 1
Public transport = 9-20
Car traffic = 60-200
So it is evident that car traffic is the mode we have to pay attention if we want to establish EST.

How mobility occurs
Essentially there are three causing factors for mobility: the first one is based on the circumstances of the potential at the origin (e.g. residents), the second one belongs to the potential at the destination (e.g. number of jobs) and the third cause depends on the resistances between origin and destination. The gravity model of transport can illustrate this connection.

Barriers „knowledge, information, misunderstanding"
The problem of barriers to EST is based in the wrong use of this fundamental model of transport planning. A glance to our roads, streets and motorways proves: on most of the observed cross sections an increase of number of cars can be seen. But this is only one part of the truth because all other transport modes drop off with the same amount. Mobility - related to the decisive parameter "mobility rate" (number of trips per person and day) – is staying the same because purposes of travel are staying the same on the whole too. The number of trips in the system is nearly constant. So the so-called "growth of mobility" during the last decades has only been a shift from one to another mode. Transport policy has to take into consideration this fact.

Modal choice
The resistances between the potentials at the origin and destination have a great impact on modal choice and vice versa modal choice influences the potentials. So a feedback control system exists on which car traffic left his mark during the last decades with relevant impacts on „traffic growth".
Resistances (W) can be described vividly by the so-called "traffic-value". The various parameters can act as barriers for EST at the one hand but can help to overcome them on the other hand.

Frequency of service:
Frequency of service favours the individual modes: pedestrians, cyclists and car users can start a trip at any time. One weak point of public transport is his dependence on a timetable. Especially during off-peak periods and in peripheral regions public transport has great problems with frequency of service. Therefore urban sprawl is a great enemy to PT.

Costs:
In this field the non-motorised modes have their greatest advantage over PT and CT but by means of the general prosperity this parameter has no great effects. As a whole the costs for buying and upkeep a car have decreased. The fare of PT is growing adequately to earnings.

Mode availability:
The own feet, mostly the bicycle and PT are available for everybody. For car traffic the car ownership rate is decisive which is in general less than one.

Travel time:
Travel time has to consider all parts of a trip (e.g. the access to PT) and that walking time is overestimated with increasing walking distance exponentially (energy-consumption of the pedestrians and quality of surroundings). Already the use of this empirical „acceptance function" eliminates mistakes of the classical Transport planning.

As a second there exists a „Dogma of time savings by increasing the speed". For a single trip everyone has the experience of time saving by a higher speed and this effect has a great influence on modal choice too. But travel time has also structural effects. Worldwide surveys have shown that the average time for mobility is the same for all societies and therefore there is no time saving in the system by higher speed obviously. But transport policy decisions are based on time savings on a large part till today. What are the influences of higher speeds then? The structures ("potentials") will change and therefore the calculation of effects of higher speeds has to take into consideration the changes in the transport system and in the structures!

The parameters of resistance – especially the frequency of service and the travel time (for system purposes better „the speed") – show that car traffic has the advantage over the other modes. Under these circumstances there must be an increase of car traffic. Because of the constant mobility-rate and the constant travel time this increase neither leads to a growth of mobility nor to time saving.

Connected with decreasing parameters of resistance for car traffic are changes in the fields of modal choice, choice of destinations and - if we think of the feedback control system – changes of the structures. In all the result is an increase of "mobility-effort". The smaller the resistances in the gravity model the greater the distances between the potentials by urban sprawl on the one side and centralisation on the other side.

On the one hand the demanded "attainability" between potentials makes it possible for the planners to have a comfortable life, for *parts* of economy to make high profits and for the politicians on the spot to have less responsibility. The traditional complex settlements are not necessary any more; external energy and high speeds keep the potentials close together. But the increasing "mobility-effort" turns to be compulsively.

On the other hand the so-called "traffic-value" describes all elements of a successful "mobility-management". All of these elements could be barriers to EST but could also be the key to reach EST if policy and transport planning uses the mentioned parameters in an adequate way. So the real barriers are the different time periods of political periods and the time period measures need to take effect, the unlimited demand for comfort, the quality of transport planners to be able to achieve EST and sustainable structures and finally the acceptance of measures to reach EST by all of the persons concerned.

Implementation Strategies: Institutional Barriers
Stephen Perkins, European Conference of Ministers of Transport

The answer to potential institutional barriers is policy integration. The challenge for EST is to become part of the integration process. And in order to do that it has to speak a language common to the other Government departments: transport, economy, finance and spatial planning.

Transport impacts must be part and parcel of the environmental impact and cost benefit assessments undertaken by spatial planning ministries. The impact on demand in transport markets is often simply not considered in the planning process. Within the transport ministries themselves, there is a growing awareness that the success or otherwise of investments in transport projects depends crucially on the way markets operate, and notably on distortions in transport prices. Taxation is vital to policy integration. There is an overwhelming case for environment, transport and finance ministers

to make decisions on transport taxes together. The first step might be to identify what purpose different parts of taxation serve, and insulate the parts designed to promote sustainable development from instability.

The underlying theme is that the common language for policy integration between ministries is the language of economics and markets. And this is a weak point in the EST project. The EST project has been very useful in improving the understanding of the challenges for achieving sustainable transport policies. Clarity is provided by backcasting: setting out a series of steps to reach the predetermined goal. However, the backcasting approach used takes no account of the way markets operate and this is likely to prove a crucial institutional barrier.

EST time horizons may be short in terms of atmospheric science, but are extremely long in economic terms. Forecasting short-term economic developments, e.g. sentiment on oil markets, is impossible. And forecasting longer term economic trends - over the 30 year time frame of EST - is made very difficult precisely by technological innovation in response to market pressures. The problem for economic policy

makers is that backcasting ignores these uncertainties. Policy makers in economics ministries finance ministries and even transport ministries will therefore have difficulty in using the results of EST, as there is no ready way to integrate them into policies for the present.

The objectives behind the EST project are important, and it is worth the extra effort to close the gap between the results of backcasting and taking practical steps to improve on present policies. Closing this gap is a task for follow-up activities to be discussed in the final session of the conference.

Stakeholder Priorities for the Implementation of EST
Mona Mejsen Westergaard, Ministry of Environment and Energy, Denmark

Though authorities are aware of the problems related to transport, and the central instruments needed to change transport in a more sustainable direction, it has been very hard to achieve the political support for the implementation of these instruments. The situation is similar in most countries - public and political support is in practice limited.

More focus needs to be put on awareness and knowledge, not only of transport problems but also on the alternatives to the dominant modes and on the advantages of shifting to them.

Finally, many measures need international commitment and co-operation to have a substantial effect.

Debate on transport related problems and the necessary means to solve them, have often ended in fierce discussions for or against the car. In Denmark, there is already a quite high taxation on fuels and on car purchase and ownership, and the public support for further taxation is limited.

In the Danish Ministry of Environment and Energy we therefore increasingly focus on "softer" measures. We find that only by changing awareness, knowledge and motivation and increasing responsibility in local governments, industry and the population as such, will we be able to promote sustainability in transport through softer measures like planning and supply and demand of more environment friendly transport modes and products. We also see this as necessary to - in time - achieve the support necessary to introduce the "hard" measures that can truly leads us towards sustainable transport, especially further internalisation of the external costs of transport and change in the prioritisation of infrastructure for different modes of transport.

More awareness on the alternatives to the private car is needed, and on the gains that can be achieved, for the individual as well as society, by shifting to more environment and health friendly

transport modes. Especially physically active modes like cycling and walking—alone or in combination with public transport—need to be recognised as valid alternatives to the car. This awareness would also promote policy and planning to obtain advantages for these modes in terms of price, time, flexibility and comfort, to secure that they provide a real alternative.

Last but not least, some of the major transport problems can only be solved by international co-operation. Besides, many measures are not used, because countries are afraid that national business will suffer, if the country uses them separately. It will only be possible to stop the steady rise in CO_2 emissions and noise and to solve the particulate problem, if we can secure a much cleaner technology, and to some extent a different technology than the fossil fuel dependant technology prevailing today. Apart from securing incentives that promote cleaner technologies, we need internationally co-ordinated policies that secure much better competitiveness for transport by rail and ship, to reduce the increase in international road and air transport. For these reasons—and because of the need to put the issue of sustainable transport high on governments' agendas—we find there is an urgent need for a new legally binding international agreement, thinking together transport, environment and health.

Swiss priorities for the implementation of EST
Bruno Oberle, Swiss Agency for the Environment, Forest and Landscape

The presented scenarios show that the problem of transport related air pollution can be solved in the long term mainly with help of exhaust standards that will push forward the technological development. Nonetheless, taking into account the huge numbers of around 1700 cases of premature death caused by air pollution in Switzerland only, short term measures such as the equipment of in-use vehicles with particle traps are urgent, too. As an example, the Swiss Canton Bern has decided to finance the equipment of all busses of the local public transport companies.

Concerning noise, the setting of stronger technological standards is important but will not be sufficient. In Switzerland priority is therefore given to modernise the rolling stock of the railways and to build noise abatement walls where necessary. 1.2 billions Euros will be spent on this until 2015. A similar approach is used to protect people from noise stemming from road vehicles and aircrafts.

Concerning wildlife protection the Swiss policy prioritises the preserving and reconstructing of the routes and paths that animals use to follow. The aim is to facilitate the genetic exchange between the populations living in the different parts of the country and to create opportunities for species like the lynx to spread to not-yet-occupied areas. Mainly with the construction of specially designed bridges across motorways serving as passages for the wild animals also this goal seems to be attainable.

The case of greenhouse gas emissions however looks much different compared to air pollution, noise and wildlife protection. Transport related CO_2 emissions are still growing and there exists no single and politically accepted measure to reduce them sufficiently. Especially worrying is that the fastest growing source is airborne transport where the potential of technical improvements seems to be much smaller than it is for landbased transport. Therefore only the combination of the three strategies will lead to success. Concerning standard setting the Swiss Directive on Energy demands a reduction of the average fuel consumption of new cars of 15% compared to 1996 until 2001.About 20 billion Euros will be invested in improving the capacity and quality of the railway system more attractive for both passenger and freight transport.. These investments will only be successful when simultaneously a fair competition between the modes of transport can be established. In order to reach fair competition environmental and social cost have to be paid for by the users and tax exemptions for airborne transport have to be cancelled. Concerning freight transport Switzerland therefore will introduce next year the mileage related tax on heavy good vehicles. At the same time there will be tighter controls of speed and weight limits and the respect of the driving hours. The law on CO_2 emissions demands for the year 2004 the introduction of a CO_2 tax of up to 50 Swiss cents per litre gasoline if necessary to reduce road transport related CO_2 emissions by 8% until 2010. Emission

related landing taxes at the airports of Zurich and Geneva promote the use of cleaner air craft engines.

As all these examples show there is room for measures taken on local and national level. But because Switzerland is a small country the effect of these measures will depend very much of what is happening world-wide and especially on what is done in Europe. Priority issues are the development of more efficient technologies, investments in a competitive European railway network, the internalisation of environmental and social costs and the introduction of taxes on airborne transport. For the supranational co-ordination and for the further development of a sustainable transport system the EST-project of the OECD as well as work done by WHO and UN-ECE in the framework of the WHO London charter and the UN-ECE Vienna Declaration on Transport and Environment have played and will play an important role.

Trying to summarise the presentations and discussions during the conference it can be stated that
1. EST is feasible: problems, causes and solutions are well known, EST is economically efficient and favours social equity
2. Stakeholders seem to be willing to participate at medium and long term
3. It is time for political decisions concerning goals, instruments and timing of implementation
4. National policies can only solve parts of the environmental problems
5. Internationally co-ordinated policies are necessary, especially for
   - Strengthening of technical standards to promote the development of efficient technologies
   - Co-ordinated investments in infrastructure
   - Internalising of environmental and social costs

Therefore Switzerland supports
- the further development of the EST-guidelines towards a internationally agreed strategy for transport policy making
- the negotiation of a WHO/UN-ECE Framework Convention on Transport Sustainable for the Environment and Health
- negotiations concerning the taxing of airborne transport and the including of airborne transport in the Kyoto Protocol

Transport business: Agenda 21 for the German Railways
Joachim Kettner, Deutsche Bahn AG, Umweltzentrum, Berlin

CO_2 emissions from the transport sector in Germany are higher than those from the industry, business, and household sectors. Their projected high growth rates present a major obstacle to achieving climate protection. The necessary, scientifically-determined goals for climate protection cannot be met by a business-as-usual approach for the sector.

Rail transport offers a great potential for reducing transport-related CO_2 emissions. CO_2 emissions per passenger- or per tonne-kilometre are 25- to 50-per-cent lower for rail transport compared to road transport or aviation. There is a high potential for reducing energy consumption and CO_2 emissions from the transport sector through large shifts of passengers and freight to rail.

German Railways see this as a call to further improve the environmental performance of its operations. In Rail Agenda 21, established in 1997, the company identified strategic areas where increasing efforts will have to be made with a view to maintaining and increasing the environmental advantages of railways. They include:
- setting conditions for a major shift from road and air to rail transport;
- reducing emissions with a view to lowering regional impacts and protecting global climate;
- reducing railway noise;
- protecting nature and landscape;
- strengthening the role of railways in urban and regional development;

- increasing cost-effectiveness of investments and operations;
- establishing environmental management and audit systems.

Several programmes, projects, and individual measures help substantiate the sustainability of the company's programme and its implementation on site.

A monitoring and reporting system is being developed for the Agenda process. It will show progress towards being a sustainable mobility service provider and provide staff with a tool that highlights achievements. The lack of uniform sustainability indicators at the national level for application at the company level presents a major obstacle for measuring progress.

German Railways expects that policy-makers will support the establishment of long-term social and environmental goals. Such quantified goals are needed to orient the company's strategic perspective.

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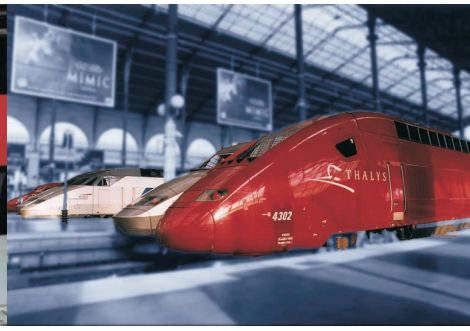
APPENDIX D: EST GUIDELINES

This appendix comprises the *EST Guidelines* brochure produced after the conference. The page numbering of the brochure has been retained. The pagination of this document is resumed on Page 145 (first page of the End Notes).





est!

environmentally sustainable transport

GUIDELINES

OECD
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Bundesministerium für Land- und Forstwirtschaft Umwelt und Wasserwirtschaft
das lebensministerium

GUIDELINES

est!

environmentally sustainable transport

futures, strategies and best practices

Guidelines for environmentally sustainable transport (EST) presented and endorsed at the international conference held from 4th to 6th October 2000 in Vienna, Austria.

The EST conference was organised by the OECD and hosted by the Austrian Ministry of Agriculture, Forestry, Environment and Water Management.

SCOPE AND PURPOSE

i. Ensuring progress towards sustainable development is a priority of the OECD's work. Transport is a particularly challenging sector. It is indispensable to modern life, but has many adverse effects on health and environment. Most transport trends are unsustainable.

ii. In 1998, Environment Ministers of OECD Member countries called on the OECD to develop guidelines for moving towards environmental sustainable transport (EST). The OECD's Working Group on Transport developed the EST guidelines based on the results and conclusions of the EST project. This OECD initiative involving many OECD and non-OECD countries provides a solution to making transport policy more sustainable and enhancing quality of life.

iii. The EST Guidelines have been developed to enable economic development and individual welfare without causing undue health and environmental impacts and depletion of finite resources. These guidelines represent a desirable and feasible approach for the transport sector that may also be of value in the sustainable development of other sectors.

iv. The Working Group on Transport has submitted the EST Guidelines for discussion and endorsement at the OECD Conference on Environmentally Sustainable Transport Futures, Strategies, and Best Practice held in Vienna in October 2000.

v. The OECD acknowledges the contributions by and assistance of participating countries, in particular those that provided case studies: Austria, Canada, France, Germany, Italy, Japan, The Netherlands, Norway, Sweden, Switzerland, and the CEI region.

I. TRANSPORT CHALLENGES SUSTAINABILITY: OECD TAKES ACTION

1. Numerous initiatives have been undertaken or proposed to reduce the negative environmental and health impacts of current transport systems. There have been significant gains with respect to specific pollutants, notably carbon monoxide and lead, from the application of regulations controlling vehicle emissions and fuel quality.

2. However, many measures lack effective implementation, in particular those targeting structural changes in transport activity and reductions in carbon dioxide emissions and noise. Continuing growth in transport activity offsets the gains achieved through technology. Overall, insufficient progress has been made towards achieving environmental sustainability for the transport sector (see Annex 1).

3. A new target-oriented approach is needed that places environment and health at the top of the policy agenda for transport and related sectors, at international, national, and local levels.

4. To this end, the Environment Ministers of OECD Member countries agreed on Shared Goals for Action (OECD Environmental Ministerial, April 1998). They requested the OECD to undertake further work on environmentally sustainable transport (EST), including the development of guidelines for implementing EST principles. In response to the Ministers' request, the OECD's Working Group on Transport elaborated the EST Guidelines based on the results and conclusions of its EST initiative

5. The EST Guidelines operationalise the Principles towards Sustainable Transportation and the Strategic Directions endorsed by the OECD Conference on Sustainable Transport held in Vancouver in 1996.

6. Furthermore, the EST Guidelines are part of the OECD's commitment to contribute to the implementation of major international conventions and other commitments, in particular:

- the UN Framework Convention on Climate Change, and its Protocols (1994/97)
- the Vienna Declaration of the UN ECE on Transport and Environment (1997)
- the WHO Charter on Transport, Environment and Health (1999)

The EST Guidelines recognise the global responsibility of each sector to contribute to the achievement of sustainable development, as stated in the 1992 Rio de Janeiro Declaration on Environment and Development and adopted in Agenda 21. They are fully in the spirit of sustainable development, formulated in 1987 by the World Commission on Environment and Development to stress the need for inter-generation equity and the integration of social, economic, and environmental objectives in all policy developments.

7. The EST project characterised EST by starting from the broad definition of sustainable development and constructing a qualitative definition for environmentally sustainable transport (see Annex 2). Health and environmental quality goals for a number of

criteria were set based on internationally agreed guidelines, standards, and goals. Six EST criteria were identified as the minimum number required to reflect the wide-ranging health and environmental impacts of transport. They concern noise levels, emissions of major air pollutants and greenhouse gases, and land use (see Annex 3).

8. The EST project used a new goal-oriented approach by constructing long-term visions of EST consistent with the EST criteria, and then proposing strategies for reaching the goals by applying a backcasting methodology. At the core of the strategies were well-phased packages of policy instruments considered capable of achieving EST.

9. Extreme solutions were rejected. Reaching EST entirely through technological advances would be costly, and also risky because necessary improvements may be beyond reach. Reaching EST entirely through changes in transport activity would entail unrealistic changes in mobility patterns, numerous restrictions, and the loss of too many of the economic and social benefits provided by transport.

10. The EST Guidelines are proposed as a basis for developing a feasible and viable strategy towards sustainable development and for future-oriented policymaking and practice in the transport sector.

II. A NEW TRANSPORT VISION: EST!

11. EST is a new transport vision and approach. It provides an appealing and plausible alternative to unsustainable 'business-as-usual'. This new transport approach comprises: (i) a portrayal of a sustainable transport future, (ii) the development of environmental and health quality objectives and criteria, and derived quantified targets with dates and milestones, and (iii) the specification and implementation of packages of measures required to achieve a sustainable transport future.

12. The key conclusions drawn from the OECD's EST project are:

- EST offers an appealing and realistic vision of a long-term sustainable transport future that provides for enhanced quality of life for present and future generations while retaining the numerous benefits of today's transport.

- 'Business-as-usual' in transport policy and practice is no longer a viable option. Growth in transport would continue, with the highest rates in road freight and aviation; modal split will become more unbalanced; and fuel use would steadily increase, as would noise and the use of land for transport. Some air pollutants could be reduced due to tight emission controls. These transport trends call for a reorientation of transport policies and practices to ensure sustainability and to maintain the benefits of the transport sector.

- EST can be defined. This requires deriving targets based on environmental and health quality objectives and criteria using internationally agreed standards, goals, and guidelines. These must fulfil local, regional and global requirements.

- EST is attainable. It requires a consistent and balanced package of measures focussing on the technology of vehicles, fuels, and infrastructure, on the one hand, and changes in transport activity and management, on the other hand. The latter involves favouring a higher share and use of environmentally sound and health beneficial modes, increasing the loading and occupancy of vehicles, reducing the need for motorised transport, changing mobility patterns and driver behaviour, and providing information and education about the efficient use of transport. EST calls for a much greater emphasis on transport demand management policies than in the past.

- EST will induce structural changes and provide for new opportunities. EST induces significant changes in technology, transport activity and mobility, and land use patterns that will require adaptations by the transport sector. It will at the same time provide opportunities for transport industry, operators and new mobility services as well as better and more balanced access to people, places, goods, and services.

- EST must be co-ordinated across sectors. It requires prioritising and implementing appropriate actions within the transport sector and other key sectors. Investment policies and financing practices as well as pricing and fiscal policies need to contribute to not counteract sustainable development of transport.

- EST can be reached through several paths, varying according to national, regional, and local circumstances. Overall, the key to success will be a well designed, co-ordinated, and broadly supported implementation strategies.

- EST provides for numerous social advantages. There would be increased accessibility through a wider choice of transport modes and thus more individual and collective opportunities.

- EST provides the opportunity for economic enhancement through the establishment of viable long-term infrastructure, the expansion of sustainable transport modes, and the avoidance of the costs of ill health, accidents, environmental degradation, and resource depletion.

- EST policies are evolutionary rather than revolutionary. Many of the elements required for it are already known or even in place, however their implementation must be strengthened and more effective. With a few new and innovative measures, and the proper implementation of currently available instruments, EST can be achieved within the time frame of a generation (30-40 years).

13. Policies for EST should adopt a goal-oriented approach akin to modern business practice. Specific environmental and health, economic and social objectives are set and detailed; quantified targets, dates, and milestones are established. Policies are formulated precisely in terms of their ability to ensure that targets are met. This approach has been used with success in managing some of transport's environmental impacts. It should be extended to all transport activity.

14. EST should build on the active participation of citizens, businesses, governments, and non-government organisations. Special emphasis should be given to promoting sustainable mobility behaviour and sustainable production and consumption patterns through information dissemination and public awareness building, in particular through the education of younger generations.

III. TOWARDS SUSTAINABLE TRANSPORT: THE EST GUIDELINES

15. The EST Guidelines have been elaborated to assist governments at all levels in the development and implementation of strategies towards EST. Effective implementation of the EST Guidelines requires strategies that accommodate the particular geographic and socio-economic conditions of countries or regions. The EST Guidelines should be used in a dynamic fashion that takes into account the latest scientific results. When starting an EST implementation process, concerned parties transport, environment, health and other sectors, government, industry, academia, and NGOs, as well as the public-at-large, should be involved to ensure widespread awareness, understanding, commitment, and acceptance.

16. OECD Member countries are called upon to use and apply these EST Guidelines and to initiate an implementation process towards achieving environmentally sustainable transport at international, national, regional, and local levels. This approach is also recommended for other countries, as well as for other sectors of the economy.

THE EST GUIDELINES

Guideline 1. **Develop a long-term vision of a desirable transport future** that is sustainable for environment and health and provides the benefits of mobility and access.

Guideline 2. **Assess long-term transport trends, considering all aspects of transport,** their health and environmental impacts, and the economic and social implications of continuing with 'business as usual'.

Guideline 3. **Define health and environmental quality objectives** based on health and environmental criteria, standards, and sustainability requirements.

Guideline 4. **Set quantified, sector-specific targets** derived from the environmental and health quality objectives, and set target dates and milestones.

Guideline 5. **Identify strategies to achieve EST** and combinations of measures to ensure technological enhancement and changes in transport activity.

Guideline 6. **Assess the social and economic implications of the vision,** and ensure that they are consistent with social and economic sustainability.

Guideline 7. **Construct packages of measures and instruments** for reaching the milestones and targets of EST. Highlight 'win-win' strategies incorporating, in particular, technology policy, infrastructure investment, pricing, transport demand and traffic management, improvement of public transport, and encouragement of walking and cycling; capture synergies (e.g., those contributing to improved road safety) and avoid counteracting effects among instruments.

Guideline 8. **Develop an implementation plan** that involves the well-phased application of packages of instruments capable of achieving EST taking into account local, regional, and national circumstances. Set a clear timetable and assign responsibilities for implementation. Assess whether proposed policies, plans, and programmes contribute to or counteract EST in transport and associated sectors using tools such as Strategic Environmental Assessment (SEA).

Guideline 9. **Set provisions for monitoring implementation and for public reporting on the EST strategy**; use consistent, well-defined sustainable transport indicators to communicate the results; ensure follow-up action to adapt the strategy according to inputs received and new scientific evidence.

Guideline 10. **Build broad support and co-operation for implementing EST**; involve concerned parties, ensure their active support and commitment, and enable broad public participation; raise public awareness and provide education programmes. Ensure that all actions are consistent with global responsibility for sustainable development.

ANNEXES 1-4

The purpose of these annexes is to describe and illustrate features of the guidelines in order to facilitate their use and application when developing and implementing EST strategies. They serve to share the lessons learned during the course of the OECD EST initiative. Care should be taken, therefore, to ensure that particular national, regional or local considerations are addressed when using these .

- Annex 1 highlights certain unsustainable trends in relation to local, regional and global scales.
- Annex 2 recalls the qualitative definition of Environmentally Sustainable Transport developed for the EST project that has been derived from the broad definition of sustainable development.
- Annex 3 presents the minimum number of criteria required to encompass the wide range of health and environmental impacts from transport, identifies health and environmental quality objectives and derives quantitative targets.
- Annex 4 provides hints and explanations as to the application of the guidelines.

ANNEX 1:
KEY SIGNS OF UNSUSTAINABLE TRANSPORT TRENDS

This brief assessment focuses on the EST criteria considered to be the minimum number to characterise the wide-ranging health and environmental impacts from transport.

Climate protection: the CO_2 criterion

Transport represents a growing source of climate-impacting emissions. Furthermore, as shares of these emissions are decreasing in other sectors, transport's share of climate-impacting emissions continues to grow. Under the assumption that no drastic interventions will occur, global CO_2 emissions from motor vehicles are projected to increase by more than 300 per cent by 2030 compared to 1990 levels. This increase is primarily due to growth in road and air traffic. In OECD countries the overall increase will be 'only' 56 per cent. Altogether, these emission increases will contribute to dangerously high concentrations of atmospheric CO_2 that are more than double the present levels.

Regional air quality: the NOx and VOC criteria

Transport's share of responsibility for causing acidification, eutrophication, and dangerous levels of tropospheric ozone continues to grow as emissions from stationary sources decline. Stringent emissions standards and targets for motor vehicle emissions have been established up to the year 2005 and beyond for all the three OECD regions in order to meet long-term air quality objectives. With the adopted standards, NO_x and VOC emissions are expected to decline by 40 to 70 percent between now and 2030, and possibly stabilise thereafter. However, air quality will not improve at the same rate due to complex transformation processes of emissions into ambient air levels, notably those concerning the production of ground-level ozone. Thus, air quality standards will be exceeded for many years to come, in terms of short-term episodic peaks as well as long-term ambient levels. Furthermore, a similar trend in emission reductions is not expected for other parts of the world, where high growth rates together with lenient controls will result in increased total emissions from transport, in particular from motor vehicles, resulting in further degradation of already-bad air quality.

Local air quality: the particulate matter (PM) criterion

The growing vehicle fleet and increasing distance travelled by road freight diesel vehicles will continue to contribute to exceedances of ambient air quality standards for PM. In the three OECD regions, stringent emission controls and use of filter technology will reduce emissions substantially over the long term. By 2030, emission levels will be much lower than today. However, air quality standards for fine particulate matter will still be exceeded for many years and a large proportion of the population will be exposed to harmful concentrations. New research on health effects suggests that exposure to ultrafine particulate matter (less than 2.5 μm) emitted from both gasoline and diesel vehicles will cause increasing public health concerns.

Quietness: the noise criterion

Transport noise, particularly from road vehicles, is the major source of external acoustic nuisance in urban areas. Engine noise has been reduced through stringent standards, but tyre and road noise levels have remained largely unchanged and have even increased. Aircraft noise is also increasing, affecting larger numbers of people. About 10 per cent of the European population is affected by aircraft noise above 55 dB(A), 30 per cent is exposed to road traffic noise above the nuisance level of 55 dB(A). The proportion of European region's population exposed to high noise levels (equivalent to 65dB(A)) increased from 15% to 26% between 1980 and 1990 (WHO Charter for Transport, Environment and Health, Annex 1, London 1999). Despite technological progress to reduce noise at the source, the prospects are less promising for the future; noise nuisances will increase near roads, airports, and railway lines due to projected increases in vehicle traffic and expansion of road infrastructure and airports.

Land use/take criterion

Land use for transport is a key issue in that it is both a factor generating transport activity (infrastructure-induced mobility) and a contributor to environmental stress (e.g., increasing pressure on biodiversity due to habitat separation, fragmentation, and destruction). Transport infrastructure, mainly roads, occupies 25-30 percent of land in urban areas and less than 10 per cent in rural areas in the OECD. Land use for transport infrastructure (roads and parking, rail corridors, airports, and harbours) is likely to increase by 2030 due to the expected strong growth in transport activity. Furthermore the expansion of road infrastructure, in particular motorways, will add barriers to the migration of many species, reducing their viability and disrupting local ecosystems.

ANNEX 2: DEFINITION OF ENVIRONMENTALLY SUSTAINABLE TRANSPORT

In the spirit of the well-accepted broad definition of sustainable development, four broad ecological principles can be derived:

- public health and the environmental quality should be preserved;
- non-renewable and renewable resources should be used sustainably;
- critical limit values for health and ecosystems should be respected; and,
- global irreversible effects should be avoided.

A sustainable transport system should provide access to people, places, goods, and services in an environmentally responsible, socially acceptable, and economically viable manner. Mobility for communication and for enabling social contacts, as well as movement of people and goods, is to be considered as a means rather than as and end in itself.

Important prerequisites for realising an EST system in the long term are these: protect human health, ensure ecosystem integrity, respect health and ecological limits (critical levels and loads), prevent and minimise pollution, ensure sustainable use of non-renewable and renewable resources and avoid human-induced changes in global environmental systems such as the atmosphere and the oceans.

A sustainable transport system is therefore one that (i) provides for safe, economically viable, and socially acceptable access to people, places, goods and services; (ii) meets generally accepted objectives for health and environmental quality, e.g., those set forward by the World Health Organization for air pollutants and noise; (iii) protects ecosystems by avoiding exceedances of critical loads and levels for ecosystem integrity, e.g., those defined by the UN ECE for acidification, eutrophication, and ground-level ozone; and (iv) does not aggravate adverse global phenomena, including climate change, stratospheric ozone depletion, and the spread of persistent organic pollutants.

Accordingly, the EST project developed the following brief definition of an environmentally sustainable transport system as one where,

> *transportation does not endanger public health or ecosystems and meets needs for access consistent with (a) use of renewable resources below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes.*

This qualitative definition has been elaborated by expanding some of the generic statements and developing quantified criteria and targets based on international environmental and health criteria and objectives.

ANNEX 3:
HEALTH AND ENVIRONMENTAL CRITERIA FOR EST

This annex describes how the broad EST definition (see Annex 2) can be operationalised by setting quantified targets based on health and environmental objectives for a minimum number of criteria that describe transport's wide-ranging impacts.

Health and environmental quality objectives have been adopted in almost all OECD countries (and in many non-OECD countries) based on national and internationally agreed goals and standards. Long-term targets -- typically for a time period of 30 to 40 years -- can be derived from these quality objectives. Intermediate targets for shorter periods of time (e.g. 10 years) could be set to supplement the long-term targets and focus policies and strategies. These specific targets should be set in accordance with economy-wide sustainable development goals and will have to take into account efforts made in other sectors towards these broader objectives. Reaching these broader objectives will imply that cost-effective and realistic solutions are applied in each sector. Also, targets should be set so as to be consistent with countries' commitments and obligations outlined in various international treaties (e.g. Long-Range Transboudary Air Pollutant Convention and its protocols, EU Directives, United Nations Framework Convention on Climate Change and its protocols, etc...). Criteria selected for the transport sector should reflect local, regional, and global environmental quality goals. The specific target levels chosen will depend on countries' specific environmental and health conditions. The environmental quality objectives, however, are valid for all countries since they represent the desired health and environmental outcome.

The targets developed in the context of the OECD's EST initiative (see box on following page) can be achieved within the time frame of a generation (30-40 years). However, in the course of the project, it became evident that some countries thought it necessary to extend the deadlines for meeting some targets (e.g. the CO_2 emission reduction target). In those cases, the level of the target remained the same while the time period was extended.

Six criteria for the transport sector have been developed for the EST initiative as being the minimum number required to encompass the wide range of health and environmental impacts from transport. These criteria have been selected so that local, regional, and global concerns are addressed, notably noise, air quality, acidification and eutrophication, tropospheric ozone, climate change, and land use. Specifically, the criteria concern emissions of carbon dioxide, nitrogen oxides, volatile organic compounds, carcinogenic particulate matter, noise, and land use. Criteria for other important impact vectors such as ultra-fine particulate emissions, waste generation, water and soil pollution, biodiversity and habitat fragmentation, and releases of persistent organic pollutants could not be quantified at present, therefore more analysis of these is required. Each criterion described on the following page is accompanied by a footnote providing the manner in which it was quantified.

Long-term Environment and Health Quality Objectives, Criteria and Derived Targets for EST

These criteria and targets were developed in the context of the OECD's EST initiative as being the minimum number required to describe EST and were selected so that local, regional and global concerns are addressed. They provide an illustration of how criteria and targets can be linked to significant environmental and health quality objectives. These targets are long-term -- specific intermediate targets and milestones should be set to focus action. The quantitative target levels below are not prescriptive and could be adapted according to national, regional or local circumstances. What is essential for the EST approach, is that target levels are set to achieve environmental and health quality objectives.

CO_2 Climate change is prevented by reducing carbon dioxide emissions so that atmospheric concentrations of CO_2 are stabilised at or below their 1990 levels. Accordingly, total emissions of CO_2 from transport should not exceed 20% to 50% of such emissions in 1990 depending on specific national conditions.[1]	***NOx*** Damage from ambient NO_2 and ozone levels and nitrogen deposition is greatly reduced by meeting WHO Air Quality Guidelines for human health and eco-toxicity. This implies that total emissions of NO_x from transport should not exceed 10% of such emissions in 1990.[2]
VOCs Damage from carcinogenic VOCs and ozone is greatly reduced by meeting WHO Air Quality Guidelines for human health and ecosystem protection. Total emissions of transport-related VOCs should not exceed 10% of such emissions in 1990 (less for extremely toxic VOCs)[2].	***Particulates*** Harmful ambient air levels are avoided by reducing emissions of fine particulates (especially those less than 10 microns in diameter). Depending on local and regional conditions, this may entail a reduction of 55% to 99% of fine particulate (PM_{10}) emissions from transport, compared with 1990 levels.[3]
Noise Noise from transport no longer results in outdoor noise Depending on local and regional conditions, this may entail a reduction of transport noise to no more than a maximum of 55 dB(A) during the day and 45 dB(A) at night and outdoors.[4]	***Land use/Land take*** Land use and infrastructure for the movement, maintenance, and storage of transport vehicles is developed in such a way that local and regional objectives for air, water, eco-system and biodiversity protection are met. Compared to 1990 levels, this will likely entail the restoration and expansion of green spaces in built-up areas[5].

1 The Second Assessment Report of the Intergovernmental Panel on Climate Change (1996) maintains that, in order to stabilise atmospheric CO_2 concentrations at near current levels, world-wide CO_2 emissions would need to be reduced by 50% to 70% with further reductions thereafter (IPCC, Second Assessment Report, page xi, Intergovernmental Panel on Climate Change, 1996). In order to allow for increases in emissions in developing countries, OECD countries should reduce their emissions by 80% or more so that a global reduction of 50% may be attained (OECD, Environmental Criteria for Sustainable Transport, OECD Environment Directorate, Paris, France, 1996). A reduction target of 50% might be more appropriate for certain countries that benefit from a favourable situation (e.g. a more environmentally favourable modal split). This was suggested by the EST pilot study for the countries of the Central and Eastern European region.

2 These criteria are set in line with the WHO guidelines for human health regarding NOx, VOC's and Ozone (WHO, 1996) and the UNECE protocols under the Convention on Long-Range Transboundary Air Pollution for ecosystem protection regarding critical loads for nitrogen deposition and critical levels of ozone (UNECE, LRTAP Convention, 1999).

3 The WHO advises that no safe threshold level can be set for fine particulate matter (smaller than PM_{10}) and ultra-fine particles (smaller than $PM_{2.5}$) below which health effects (including cancer) do not occur. However, countries should set targets based on dose-effect considerations. The targets set here are preliminary due to the ongoing research on the health effects from ultrafine particulate matter (WHO, Air Quality Guidelines, World Health Organization Regional Office for Europe, Copenhagen, Denmark, 1998).

4 This criterion is based on the former WHO recommendation on noise that has been recently updated in the WHO Guidelines for Community Noise (WHO, Guidelines for Community Noise, World Health Organization, Geneva, 1999).

5 Quantification of the land-use criterion will require further research.

ANNEX 4:
THE EST GUIDELINES CHECKLIST

Guideline 1

Develop a long-term vision of a desirable transport future that is sustainable for environment and health and provides the benefits of mobility and access.

☑ **The vision should guide policy.** Policy-making can be framed by the negative ("avoid making things worse") or by the positive ("work towards a better situation"). On the assumption that the positive is better than the negative, society should look principally to where it wants to go, not to what it wishes to avoid. A vision for environmentally sustainable transport should answer this need.

☑ **The vision should be long-term.** Adapting any sector to the requirements of sustainable development will not occur overnight. The vision should sufficiently far removed from the present to allow for major changes yet set not so far into the future to make it unrealistic. A time horizon of 30 to 40 years seems appropriate.

☑ **The vision should inspire action.** It should present an alternative transport scenario that delivers real social, environmental, and economic benefits. These benefits need to be described in both a quantitative and qualitative manner.

☑ **The vision should be positive.** The negative rarely inspires people. A vision that repeats looming threats in crescendo will likely turn away many more people than it will attract. The vision should be couched in terms of what is to be gained from EST and what might be lost through inaction.

☑ **The vision should be ambitious, sound and realistic.** It should be supported by detailed scientific and quantitative analysis supplemented by more qualitative descriptions. A realistic vision can be ambitious, but not all ambitious visions are realistic.

☑ **The vision should be built from the ground up**. Like a house, the vision should have a strong foundation. Such a foundation builds on the collected aspirations of different key stakeholders in society. A vision that does not address and incorporate these aspirations will not compel and will ultimately fail.

☑ **The vision should be tailored to a broad range of actors.** Concrete descriptions of daily life and of the operating environments of different types of households, firms, and industries should be portrayed in order to translate the vision into practical terms.

Guideline 2

Assess long-term transport trends, considering all aspects of transport, their health and environmental impacts, and the economic and social implications of continuing with 'business as usual'.

☑ **An essential step in moving towards EST is determining whether society is on the right path**. Developing an understanding of where 'business-as-usual' will lead provides policy-makers with insight as to the scope and scale of the changes needed to achieve EST.

☑ **The BAU forecast should be realistic.** Determining 'business-as-usual' involves some uncertainty as changes will occur that cannot be accurately foreseen. At a minimum, a BAU forecast should account for all present, planned, and reasonable foreseeable policies and technological, economic, and social changes.

☑ **The BAU forecast should reflect a number of viewpoints.** Depending on your viewpoint, BAU can look good or bad. In developing the BAU forecast, great care should be taken to involve a wide range of parties and interests so that they can not only provide their own view on the future but also have their views balance the optimism and pessimism of others.

☑ **The BAU forecast should cover the same time frame as the EST vision.** Too short a time period could favour BAU on account of predictable short-term improvements (e.g., in air quality); while too long a period could render the forecast useless because of the inherent uncertainty associated with long-term projections.

Guideline 3

Define health and environmental quality objectives based on health and environmental criteria, standards, and sustainability requirements.

Environment & health objectives		Derived targets
Noise WHO Guidelines attained	⇨	Noise sources: **- 50% - 70%**
Air quality WHO Guidelines (NO_2, PM) Critical levels for Ozone attained	⇨	Air emissions: **- 50% NOx; >-99% PM** **- 80% NOx & VOC**
Acidification / Eutrophication Critical Loads attained	⇨	SO_x- / NO_x- Emissions: **- 75% - 80% (- 50% NH_3)**
Climate protection Stabilisation of CO_2 conc.	⇨	GHG / CO_2 Emissions **OECD -80% , Global -50%**

☑ **Basic health and environment quality objectives should form an integral part of all policies related to transport activity**. Commonly, transport policy is couched in economic and social terms. These concerns are integrated 'upstream' in order to formulate specific policy responses within and outside the transport sector. Health and environmental impacts are typically assessed ex-post and this understanding is used 'downstream' to develop mitigation strategies. EST calls for health and environmental quality objectives (e.g., clean air, avoiding morbidity and mortality, ecosystem protection, avoiding anthropogenic climate change, etc.) to be integrated from the outset.

☑ **EST health and environmental objectives should reflect the best available understanding of impacts on human health and the environment.** A wide range of recognised and agreed-upon criteria, standards, guidelines, and other sustainability requirements exist. These should form the basis for characterising EST (see the Figure above).

☑ **Health and environmental quality objectives are valid for all countries** -- the criteria and targets that are derived from these depend on specific national, regional and/or local conditions.

☑ **The characterisation of EST should be dynamic**. Our understanding of the health and environmental impacts from transport is continually evolving. As this understanding evolves, so should the health and environmental objectives.

☑ **The objectives should reflect the broadest views on the health and environment impacts of transport.** Existing international criteria, standards, guidelines, and other sustainability requirements should be taken into consideration when no corresponding national guidance exists. Where international criteria, standards and guidelines are more stringent than national; requirements, care should be taken to demonstrate the necessity for weaker standards in light of health and environmental objectives. Regional exceptions should be fully justified.

☑ **Criteria, standards, guidelines, and other sustainability requirements that can be quantified, should be quantified.** Those that cannot be quantified should be developed in such a way as to include a broad range of viewpoints (e.g. industry, trade unions, governments, academia, NGOs, as well as groups of population at higher risk such as children, handicapped people, the elderly, etc.).

Guideline 4

Set quantified, sector-specific targets derived from the environmental and health quality objectives, and set target dates and milestones.

☑ **EST targets for pollutants, greenhouse gas emissions, noise, land-take, etc. should be based on the health and environmental quality objectives outlined in Guideline #3**. Targets for the reduction of environmental health impacts from transport can be relative (e.g., incremental improvements from the present state) or absolute (measured against a defined end-state). Moving towards EST should be based on absolute rather than relative targets to ensure fulfilment of health and environmental objectives.

☑ **Targets should be set taking into account the specific conditions at the national, regional or local level.** Target levels will be dependent on actual baseline levels for different criteria.

☑ **EST targets should be set in reference to a baseline date.** The choice of a baseline date is important as it can mask or accentuate the changes necessary to reach the EST targets. To avoid confusion, all targets should share the same baseline date (given data availability). The selection of the date should be made openly and should involve descriptions of the relevant underlying trends in transport-related phenomena.

☑ **EST targets should be set in reference to a deadline.** Setting an end-date for achieving EST targets ensures that the process of moving towards EST is verifiable. Intermediate targets and milestones should be established to allow progress to be tracked and policies to be adjusted.

☑ **As for the criteria, standards, guidelines, and other sustainability requirements outlined in Guideline #3, targets that can be quantified, should be quantified**. Those that cannot be quantified should be developed in a qualitative way and as concretely as possible taking into account best available scientific knowledge.

☑ **Targets and deadlines for EST should evolve as new information becomes available**. As scientific understanding of the environmental and health impacts progresses, so should the EST targets and deadlines. However, changes to these targets and deadlines should be made openly and with the involvement of a wide range of societal interests.

Guideline 5

Identify strategies to achieve EST and combinations of measures to ensure technological enhancement and changes in transport activity.

☑ **The initial direction for the EST strategies should be set by the already-developed long-term vision of a desirable transport future**. This will imply a 'balance of effort' for attainment of EST in terms of technological improvements, on the one hand, and changes in transport activity such as mode shifts, more efficient occupancy or loading of vehicles, and overall reductions in travel and freight movement, on the other hand. All EST strategies will likely comprise a mix of the two types of approach, perhaps in more-or-less equal amounts.

☑ **A quantified 'balance-of-effort' analysis should be performed** in order to determine the contribution of technology (unit emission improvements, efficiency improvements, vehicle downsizing) for the various passenger and freight modes and the contribution from activity changes (traffic avoidance), modal shifts, and increasing load/occupancy factors.

Guideline 6

Assess the social and economic implications of the vision, and ensure that they are consistent with social and economic sustainability.

☑ **The economic and social implications of EST should be contrasted to the social and economic assessment of the BAU case**, not only in reference to the base case.

☑ **External costs -- those costs not currently incorporated into the price structure for transport related-activities and services (e.g., environmental and health costs stemming from accidents, air pollution, noise levels, and climate change) must be accounted for when assessing the economic viability and implications of EST**. Past economic assessments of transport policy have mostly confined themselves to what is readily measurable at the micro, meso, and macro scales. Recent assessments, however have sought to account for costs that are not reflected in the price structure of transport markets. This trend should be continued and strengthened in the assessment of EST visions and strategies by openly incorporating the best current assessment of the scope and scale of such costs.

☑ **The validity and durability of external benefits -- those benefits not currently incorporated into the price structure for transport-related activities and services (e.g., 'time savings' leading to economic efficiency gains, 'congestion reduction', etc.) -- should be carefully examined when assessing the economic viability and implications of EST.** Many past transport policy decisions have been underpinned by the expectation that general welfare benefits can accrue to the public through new infrastructure construction. These expectations have rarely been met in the long term. Assessments of BAU and EST should carefully and openly check the validity of these benefits.

☑ **When examining the social acceptability and implications of EST, care should be taken to incorporate a wide range of societal needs** (e.g. industry, trade unions, governments, academia, NGOs, as well as groups of population at higher risk such as children, handicapped people, the elderly, etc.). Social benefits and disbenefits accrue in varying proportions to different sectors of society. Assessments of the social outcomes of BAU and EST should identify potential winners and losers in order to better inform policy-making.

Guideline 7

Construct packages of measures and instruments for reaching the milestones and targets of EST. Highlight 'win-win' strategies incorporating, in particular, technology policy, infrastructure investment, pricing, transport demand and traffic management, improvement of public transport, and encouragement of walking and cycling; capture synergies (e.g., those contributing to improved road safety) and avoid counteracting effects among instruments.

☑ **The first step is to identify potential instruments (measures) that could contribute towards the improvements in technology and changes in transport activity needed to meet the EST targets.** Some or all of these instruments will comprise the critical elements of the EST implementation strategy.

☑ **Then, instruments should be selected for inclusion in the strategy that are together capable of ensuring that the EST targets are met**, in a manner that is consistent with the long-term EST vision and provides for positive rather than negative social and economic effects.

☑ **The selected instruments will likely address numerous aspects of transportation.** On the one hand, they will include instruments that can secure the improvements in technology and changes in infrastructure needed for the attainment of EST. On the other hand, they will include instruments that secure the needed changes in transport activity through demand management, which could include incentives to reduce the need for travel and provide alternatives to individual ownership and use of vehicles. These instruments should also help facilitate a shift towards more environmentally friendly modes such as public transport, walking and bicycling. Finally, these instruments should address improved driver training, education and awareness-raising for sustainable mobility, land-use, production and consumption.

☑ **The selected instruments will likely include fiscal measures, regulatory measures, and measures to educate and change attitudes about transport.** Incentives should be considered as much as price increases and penalties. Incentives to reduce specific forms of transport activity should be considered only in conjunction with the provision of more environmentally benign alternatives.

☑ **As far as possible, the selected instruments should be synergistic or complementary rather than antagonistic or perverse in their effects.** For example, fuel efficiency measures applied in isolation can initially reduce fuel use and emissions, but if transport costs are thereby reduced such measures can increase transport activity, thus offsetting much of the reductions in fuel use. Therefore fuel efficiency measures should be used in conjunction with measures to manage transport demand. Some EST instruments can bring benefits beyond those of attaining EST, for example improvements in safety and in access by elderly persons and children. Use of such instruments should be emphasized in the development of an implementation strategy.

☑ **Thus, the implementation strategy should be thought of in terms of well-coordinated packages of instruments,** rather than as an assemblage of individual instruments operating in isolation.

Guideline 8

Develop an implementation plan that involves the well-phased application of packages of instruments capable of achieving EST taking into account local, regional and national circumstances. Set a clear timetable and assign responsibilities for implementation. Assess whether proposed policies, plans, and programmes contribute to or counteract EST in transport and associated sectors using tools such as Strategic Environmental Assessment (SEA).

☑ **The implementation strategy should comprise a schedule of deployment of numerous packages of instruments over the whole of the target period, carefully phased in relation to the milestones.** Development of the strategy may well require several iterations.

☑ **The instrument packages should be carefully orchestrated into a gradual progression that initially focuses on securing acceptance of the use of the more effective instruments and subsequently deploys these instruments.** Thus, initial instruments should include much in the way of education, building on the outreach processes employed during the development of the plan. They might also include instruments that 'pave the way' for unfamiliar or unpopular instruments to be applied in a later phase.

☑ **The implementation strategy should include a clear timetable for the deployment of instruments and their assessment.** The timetable should be organised according the milestones that have been determined. It should be flexible and amenable to adjustment in the light of circumstances and assessed progress towards sustainable transportation.

☑ **Responsibilities for implementation should be assigned.** The complexity of modern societies requires that many governments and agencies play a role in securing EST, at many levels of organisation from neighbourhood to international. Assignment of responsibilities for action and their coordination are critical components of any implementation strategy.

☑ **Strategic Environmental Assessment** has been defined as "The formalised systematic and comprehensive process of evaluating the environmental impacts of a policy, plan or program and its alternatives, the preparation of a written report on the findings, and the use of the findings in publicly-accountable decision-making." The implementation strategy and its significant components should be subjected to this kind of assessment.

☑ **Ensure that the environmental and health impacts of transport are included within the scope of performance assessments** such as ISO 14001 and Eco-Management and Audit Schemes (EMAS)

☑ **An important feature of an implementation plan should be provision of the means to sustain the changes that have been achieved.** When EST is attained, attainment will continue only to the extent that appropriate instruments continue to be applied. Evidence to date suggests that without constraints transport activity and emissions will increase.

Guideline 9

Set provisions for monitoring implementation, and for public reporting on the EST strategy; use consistent, well-defined sustainable transport indicators to communicate the results; ensure follow-up action to adapt the strategy according to inputs received and new scientific evidence.

☑ **The monitoring system should not be an afterthought but rather an integral part of the strategy that is provided for at an early stage of its development.**

☑ **Several kinds of monitoring will be required.** The most important monitoring will be in relation to the targets that are used to characterise EST. This may require good data collection with respect to emissions and atmospheric concentrations of nitrogen oxides or noise exposure and land take, for example. Transport activity of all kinds will need to be carefully monitored as well as the key drivers of transport activity such as levels of vehicle ownership. This monitoring should also look at key parameters such as changes in modal split. Good indicators of transport's impacts, therefore, will be needed. Monitoring of public attitudes towards the deployed instruments and the changes in transport activity would also be useful.

☑ **Monitoring and assessment have value only to the extent that they can result in meaningful changes as to which instruments are used and how they are used.** Effective reporting is required. The implementation strategy must thus be of a kind that permits appropriate changes to be made in order to secure more certain attainment of EST.

Guideline 10

Build broad support and co-operation for implementing EST; involve concerned parties, ensure their active support and commitment, and enable broad public participation; raise public awareness and provide education programmes. Ensure that all actions are consistent with global responsibility for sustainable development.

☑ **People that will benefit or suffer from transport policy decisions should have a voice in shaping the transport system**. This requirement calls for the early integration and balancing of many viewpoints in society, including those that have usually been under-represented in transport policy-making like women, handicapped people, children and the elderly.

☑ **The role of education in the implementation of EST is paramount.** Consideration of EST itself is an educational tool. Much of the resistance to change in transport results from the lack of appealing, properly formulated alternatives.

☑ **Education and information about EST should be integrated with general concerns about the fate of future generations.** Transport should not be considered in isolation from other sectors of human activity. Current concerns should be considered in the light of their likely effects on grandchildren and their grandchildren. Individual and family concerns need to be balanced with those of society and humanity as a whole.

☑ **Implementing EST will require a structured plan of action and close co-operation among a broad range of stakeholders** from many sectors including transport, environment, health, finance, industry academia and civil society including NGO's.

END NOTES

[1] The first international conference on the EST project was held in Vancouver in March 1996. It was organised by the OECD and hosted by the Government of Canada. The 203-page printed report on the Vancouver conference is *Towards Sustainable Transportation: Conference Highlights and Overview of Issues*, published by the OECD in 1997 (also separately in French as *Vers des transports durables: points saillants de la conférence et aperçu des enjeux*). The full conference documentation is available on a bilingual CD-ROM produced by Environment Canada and entitled (in English) *International Conference, Towards Sustainable Transportation, Vancouver, Canada, March 24-27, 1996)*. The hosting agencies and ministries of the Government of Canada were the Canada Mortgage and Housing Corporation and the Ministries of Environment, Foreign Affairs and International Trade, Health, Industry, Natural Resources, and Transport.

[2] *Synthesis Report: est! environmentally sustainable transport, futures strategies and best practices*. Austrian Ministry of Agriculture, Forestry, Environment and Water Management, Vienna, and Organisation for Economic Co-operation and Development (OECD), Paris, October 2000.

[3] The report on the study concerning Central European countries is UNEP/OECD/Austria, *Towards Sustainable Transport in the CEI Countries* (Ministerial Declaration and Joint Pilot Study on Environmentally Sustainable Transport in the CEI Countries in Transition). United Nations Environment Programme, Organisation for Economic Co-operation and Development, Federal Ministry of Environment, Youth and Family, Vienna, Austria, 1999.

[4] See Note 1 for details of the Vancouver conference.

[5] In April 2001, the definition was adopted by the European Union Council of Ministers of Transport and Communications. It is a slightly modified version of the definition initially developed by the Toronto-based Centre for Sustainable Transportation, which was inspired in part by the OECD's EST project. A sustainable transport system is defined as one that:

- allows the basic access and development needs of individuals, companies and societies to be met safely and in a manner consistent with human and ecosystem health, and promotes equity within and between successive generations;
- is affordable, operates fairly and efficiently, offers choice of transport mode, and supports a competitive economy, as well as balanced regional development;
- limits emissions and waste within the planet's ability to absorb them, uses renewable resources at or below their rates of generation, and, uses non-renewable resources at or below the rates of development of renewable substitutes while minimising the impact on the use of land and the generation of noise.

[6] Unless otherwise indicated, the sole known sources for the boxes in this report are the respective presentations at the Vienna conference. Box 2 is one of the exceptions. Although presented at the conference, the version here is from Umwelt- und Prognose-Institut Heidelberg e.V., 1991, *Scheinlösungen im Verkehrsbereich. Kontraproduktive und ineffiziente Konzepte der Verkehrspolitik* (UPI-Bericht Nr. 23), Heidelberg, p. 15.

[7] Box 7 is from Walsh MP, *Global Trends in Diesel Emission Regulation, A 2001 Update*, Society of Automotive Engineers, 2001.

[8] The EST report on central and eastern Europe is detailed in Note 3.

[9] The *Mobility 2001* report of the World Business Council on Sustainable Development was issued in October 2001. It is available at <www.wbcsdmobility.org>.

[10] Box 18 is from *Mobility at your convenience: Car sharing – the key to combined*

mobility; Energie 2000, Swiss Federal Office of Energy, Bonn, 1998.

[11] The EST report on central and eastern Europe is detailed in Note 3.

[12] As noted in Section 1.1, the *EST Guidelines* were endorsed by OECD Environment Ministers at their meeting in May 2001.

[13] For example, implementation of the Phase 2 Rule of the U.S. Environmental Protection Agency is expected to reduce both NO_x and particulate emissions from new 2007 highway diesel vehicles by more than 95 per cent compared with new 1991 vehicles (Mary Manners, US EPA, *overview of the New Vehicles and Engine Exhaust Emission and Fuel Quality Standards in the U.S.A.,* Energy Outlook 2001 conference, Washington DC, March 27, 2001).

[14] See, particularly, the report on aviation of the Intergovernmental Panel on Climate Change: Penner JE et al. (eds.) *Aviation and the Global Atmosphere.* Cambridge University Press, Cambridge UK, 1999.

[15] For a further exposition of the analysis to the effect that production of conventional oil will decline, see Colin Campbell, *Peak Oil: A Turning Point for Mankind*. Presentation at the Technical University of Clausthal, Germany, December 2000 (available at <energy-crisis.org/de/lecture.html>).

[16] Discussion of the likely balance of effort required for attainment of EST appears in Section 1.3 of the report on Phase 3 of the EST project: *Policy Instruments for Achieving Environmentally Sustainable Transport* (OECD, 2001).