

*Social  
Change and  
Sustainable  
Transport*

**S C A S T**

*A Summary of Workshop  
and Conference Activities,  
Research Needs and Future  
Directions*

**William R. Black  
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# **SOCIAL CHANGE AND SUSTAINABLE TRANSPORT**

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**8 2000 William R. Black**

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## Contents

<b>Preface</b> .....	<b>vi</b>
<b>Chapter 1 Introduction</b> .....	<b>1</b>
<b>Chapter 2 Social Change and Sustainable Transport: Toward Transatlantic Research Agenda</b> .....	<b>5</b>
<b>Chapter 3 The Berkeley Conference</b> .....	<b>23</b>
<b>Chapter 4 Research Needs</b> .....	<b>27</b>
<b>Chapter 5 Future Directions</b> .....	<b>85</b>
<b>Appendices</b> .....	<b>89</b>
<b>Appendix A Workshop Attendees</b> .....	<b>90</b>
<b>Appendix B Berkeley Conference Attendees</b> .....	<b>92</b>

## Preface

This document is intended to be a record of the activities undertaken to create a transatlantic transport research program that would look at questions related to changes taking place in society that impact travel and transportation, as well as the entire array of questions related to sustainable transportation. The SCAST (Social Change and Sustainable Transport) effort began in 1996 through the generous financial support of the National Science Foundation (NSF) and the European Science Foundation (ESF). It continues at present with the development and submission of research proposals to funding organizations on both sides of the Atlantic.

This document includes discussions of how the ideas and themes pursued were developed and nurtured. To this end there are summaries of several workshops and a major conference here. Perhaps the part of this document that will be the most useful to scholars and researchers are the research needs statements included here. Most of us involved in this effort would like to see the research needs presented here undertaken by teams of international researchers that will provide greater insights than research done only on one side of the Atlantic.

The activities described here were not due to the actions of a single individual or even a small group of individuals, but were the result of the actions of several people on both sides of the Atlantic. Obviously, the major contacts with the National Science Foundation (NSF) and the European Science Foundation (ESF) must be singled out for special recognition. These were Tom Leinbach of NSF and John Smith of ESF; these individuals care very much about the social science research and none of this would have happened without their assistance and guidance. My co-chairs on the NSF-ESF transport research committee, Kingsley Haynes of George Mason University, Peter Nijkamp of the Free University of Amsterdam and Ken Button, initially from Loughborough University and later George Mason University, were very helpful through this process. Although Peter Nijkamp and I found it expedient to make many decisions on our own, we could always depend on Kingsley and Ken to lend a hand.

The authors of our major theme papers in Lugano deserve a special thanks. They are: Michel Beuthe (Facultés Universitaires Catholiques de Mons), Andy Gillespie (University of Newcastle), Genevieve Giuliano (University of Southern California), David Greene (Oak Ridge National Laboratory), David Hodge (University of Washington), Don Janelle (University of Western Ontario), Heli Koski (ETLA, The Research Institute of the Finnish Economy), Pete Rietveld (Vrije University - Amsterdam), Roger Stough (George Mason University) and Michael Wegener (University of Dortmund). These researchers helped direct the course that these meetings and the effort would take.

I must acknowledge the help, support and encouragement we received from Marty Wachs, Bill Garrison, and Mel Webber of the University of California at Berkeley. They were keys to the success of the Berkeley side of this project.

My sincere thanks as well to the support offered by Genevieve Schauinger (ESF), Karen Frick (University of California at Berkeley), Susan White and Elaine Yarde (both of Indiana University).

Our progress was guided by the various steering committees that participated in setting up our next steps in terms of workshops or the main conference. In this regard one must recognize, aside from the various co-chairs above, the time and contributions of David Boyce (University of Illinois - Chicago), Andy Gillespie (University of Newcastle), Genevieve Guiliano (University of Southern California), Guido Martinotti (Università degli studi di Milano Bicocca), and Michael Wegener (University of Dortmund).

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## Chapter 1 Introduction

During the spring of 1999 more than one hundred transport researchers met on the campus of the University of California at Berkeley in order to discuss emerging transport problems in the area of social change and sustainable transportation. During a three day conference more than eighty research papers were presented and discussed. The papers covered research problems and trends observable in the United States, Canada, and across most of Western Europe. Some of these problems stem from changing social trends, such as increases in the proportion of the population that is aged or increases in motor vehicle ownership, while others concern social and economic impacts resulting from sustainability issues, such as pollution of local and global environment and diminishing petroleum fuel reserves. Attendees offered stimulating research frameworks for the analysis of many of the problems identified.

The early seeds for this conference grew out of a European paper authored by Nijkamp and van Geenhuizen that was originally presented at a meeting of the European Science Foundation (ESF) that was also attended by representatives of the U.S. National Science Foundation (NSF).<sup>1</sup> The paper was of a strategic nature and sought to draw attention to the need for research on alternative futures. The Geography and Regional Science area of the NSF requested that a response be prepared from the North American side. What was actually a U.S. response approached the research and problems from the perspective of emerging methods and trends and what needed to be done in these areas. It concluded by placing most of the research problems in existence under the broad heading of sustainable transportation.<sup>2</sup>

An NSF-ESF sponsored workshop at the Arlington offices of NSF brought together a group of about 25 researchers from North America and Europe charged with the mission of responding to and expanding on the ideas presented in the two initial papers. Most of these responses were later published.<sup>3</sup> The discussion that followed these presentations suggested that

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<sup>1</sup> The paper was later published as Peter Nijkamp and Marina van Geenhuizen (1997), AEuropean transport: challenges and opportunities for future research and policies,@ *Journal of Transport Geography*, 5, 1, 4-11.

<sup>2</sup> This paper was published as William R. Black (1997), ANorth American transportation: perspectives on research needs and sustainable transportation,@ *Journal of Transport Geography*, 5, 1, 12-19.

<sup>3</sup> These appeared in the *Journal of Transport Geography*, Volume 5, Number 1, 1997. They are: T.R. Lakshmanan, ATechnical changes in transportation: social and institutional issues,@ 20; K. Haynes, AIntermodalism,@ 21-22; K. Haynes, AInfrastructure,@ 23-24; R. Stough, ATransportation and safety,@ 25-26; L. Schintler, ACongestion,@ 27; D.L. Greene, AEnvironmental impacts,@ 28-29; D.L. Greene, AEnergy for transportation,@ 30-32; D.C. Hodge, AAccessibility-related issues,@ 33-34; D. Niemeier, ASystems evaluation,@ 35; E. Weiner, ATravel characteristics,@ 36; W.R. Black, AFull costing of travel,@ 37; E. Weiner, ATravel market saturation,@ 38; D.G. Janelle, ASustainable transportation and information technology: suggested research issues,@ 39-40; D.C. Hodge, AAttitudes and future transportation,@ 41; G. Giuliano, ATrip budgets,@ 42; G. Giuliano, AFamily structure and travel demand,@ 43; G. Giuliano, AAge and trip-making,@ 44; R.

most of the major research questions and needs fell within five broad topical areas: sustainable transport, social change, globalization, information and communication technology, and institutional considerations. These are discussed in more detail in Chapter 2. Workshop directors decided that these five areas needed further attention and five groups of scholars, consisting of one European and one North American, were asked to prepare papers over these.<sup>4</sup> These papers and the subsequent workshops, one in Strasbourg, France, and one in Lugano, Switzerland, and these activities are discussed in Chapter 2 as well.

A brief overview of the Berkeley Conference appears as Chapter 3. This is followed by Chapter 4, which contains the research needs statements identified at the Berkeley Conference. Lists of participants in the workshops and the Berkeley conference appear in appendices A and B. Chapter 5 suggests the manner in which the SCAST concept can continue to move forward. This envisions exchanges of students between North America and Europe, workshops and seminars, as well as the development of a network of scholars on the North American side to complement the NECTAR group in Europe.

This report has three primary objectives. The first objective is to present a summary of the activities that took place with the intent of explaining how this joint NSF-ESF effort to develop a research program evolved over approximately three years. The second objective is to present the research needs statements that were developed at Berkeley so that researchers and funding agencies can examine these with the hope that they will undertake the research in the former case and support the research in the latter case. The third objective is to inform transport researchers of the further activities of SCAST, the formation of a thematic network of scholars, and additional activities related to research in social change and sustainable transport.

The chairs of this effort from North America and Europe are reviewing the manuscripts presented at Berkeley with the intent to assemble a number of these into a book that gives a reasonably good representation of the ideas and notions advanced there. Abstracts of those papers

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Arnett, Transportat project appraisal/ cost benefit analysis,@ 45; W.R. Black, ANew approaches to modeling travel,@ 46; W.R. Black, AVirtual reality and three dimensional visualization,@ 47; E. Weiner, AAreas in need of additional research,@ 48; M. Beuthe, AComments on common research proposals in transportation,@ 49; K. Button, ASome thoughts on the NSF and ESF papers,@ 50-51; A. Gillespie, Strategic research issues of high importance,@ 52; H. Koski, AInformation and communication technologies in the transport sector and their socio-economic impacts,@ 53-54; A. Reggiani, >Towards new models and approaches in a European transport perspective.@ 55-56; P. Twaalfhoven, AStrategic research issues,@ 57-58; R. Vickerman, AViews on strategic transport research,@ 59; M. Wegener, AIssues for a European - American research programme on the future of transport,@ 60.

<sup>4</sup> These papers appeared as a special issue of the *Journal of Transport Geography*, Vol. 5, Number 3 and are: G. Giuliano and A. Gillespie, AREsearch issues regarding societal change and transport,@ 165-176; D.L. Greene and M. Wegener, ASustainable transport,@ 177-190; D. Hodge and H. Koski, AInformation and communication technologies and transportation: European-U.S. collaborative and comparative research possibilities,@ 191-197; D.G. Janelle and M. Beuthe, AGlobalization and research issues in transportation,@ 199-206; and, R.R. Stough and P. Rietveld, AInstitutional issues in transport systems,@ 207-214.

were distributed at the Berkeley conference.

It should be apparent from the previous two pages that there has been a considerable amount written about what came to be called SCAST. Overviews of various aspects of the program have also appeared.<sup>5</sup>

Interest continues in the area in Europe and the North America. On the American side «social and economic factors in transportation» has long been recognized as a major research area and is so recognized by the Transportation Research Board (TRB) of the National Research Council in the U.S. The TRB also created a task force on sustainability and transport in 1999.

Those involved in the development of the SCAST effort to develop transatlantic approaches to common research problems are sincere in their desire to see many of the research needs noted here undertaken, and it is hoped that the release of these in the current format will facilitate movement toward that end.

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<sup>5</sup> See T.R. Leinbach and J.H. Smith (1997), «Development of a cooperative international interdisciplinary program on social change and sustainable transport», *Journal of Transport Geography*, Vol. 5, No. 1, 1-3; W.R. Black (1997), «The NSF-ESF Research Program on Social Change and Sustainable Transport: The Strasbourg Papers», *Journal of Transport Geography*, Vol. 5, No. 3, 163; K. Button and P. Nijkamp, «Social change and sustainable transport», *Journal of Transport Geography*, Vol. 5, No. 3, 215-218; «Transatlantic transport», *ESF Communications*, No. 39, 1998-99, 7; and «A transatlantic route to sustainable transport», *ESF Communications*, No. 40, Autumn 1999, 20-21.



## **Chapter 2 Social Change and Sustainable Transport: Toward a Transatlantic Research Agenda**

The twentieth century has brought about major changes in mobility that are unsurpassed in human history. These changes have influenced every aspect of the social, economic, political and physical environment within which human populations function. For the most part society has fostered these changes. High levels of mobility were sought and encouraged as something that would only benefit the world through expanding trade, cooperation, cultural understanding, and economic growth. By the sixth decade of this century, it became clear that these great benefits brought with them significant associated costs. To a large extent we have now entered an era where we are trying through various means to discourage high levels of mobility, realizing that these are not sustainable. In effect, we must reverse or at least slow the increasing mobility trend of this century, without sacrificing the benefits it has given us.

The United States and parts of Europe have been at the center of the transport and mobility developments of this century. They have experienced the problems of heightened individual mobility including high levels of traffic congestion, pollution from motor vehicles, excessive highway fatalities and injuries, and chaotic land use and development. They have also seen that growth of mobility and transport lead to changes in the behavior of individuals and families, the disruption of neighborhoods and the decentralization of cities, only to now see these human and social units stimulating further demand for transport. They have seen public and private transport industries attempt to handle the excess capacity of this high mobility with privatization and deregulation. High levels of mobility have also brought about globalization of industrial production and consumption, often with the relocation of economic activities and the hardships that this implies. They have also been at the forefront of the battle to provide transport and mobility through technological and management techniques without the aforementioned disbenefits.

Although transport is often considered an area of technical and engineering research, this is not true of the problems and changes noted above. These are explicitly problems of the social, behavioral and economic sciences. Our choices of transport modes and vehicles stem from psychological processes that are not well understood. Our travel patterns are influenced and determined by cultural, social, spatial, behavioral and environmental factors. How governments react to most transport problems today is determined by their social, political, legal and economic systems. One could go so far as to say that we have solved nearly all of the scientific and engineering problems of transportation, we must now make these solutions economical and politically acceptable. In other words, it is now time to solve the social science problems of transport.

Although the United States and Europe have each experienced the rise in mobility and the changes noted above, it is fair to say that the social science of the problems they are currently encountering is for the most part not well understood. It was an awareness of the problems and a desire to better understand them that brought together a group of transport researchers in June of 1996 under the transatlantic sponsorship of the European Science Foundation and the National Science Foundation at the facilities of the latter in Arlington, Virginia. The meeting was also

stimulated by the desire to see if there was any merit in pursuing a series of coordinated and comparative research projects on transport problems in Europe and the United States.

### **The Arlington Workshop: Origins of the Agenda**

As a point of departure all attendees were sent copies of two papers. The first paper was an examination of future research needs in transport on the continent in light of the move toward a united Europe.<sup>6</sup> It noted that provision of transport in Europe was at a crossroads of antagonistic interests that could be described as a concern for strategic economic growth, a need for geographical accessibility, and issues regarding the quality of life. Although primarily concerned with contemporary problems the document did lay out a series of four transport images or futures for Europe that typify the extremes of the transport solutions available. The first future is *Mobile Europe*, which is rooted in individualization, economic/technical efficiency and urban dispersal. Although not acknowledged as such, it is the U.S. experience of the last quarter century replayed in Europe. A second image is *Techno-Europe*, not at all unlike the current perspective in the U.S. that views all problems as solvable by technology, e.g., increased fuel efficiency, catalytic converters, and intelligent transport systems. A third image or future is *Homebound Europe*, an isolationist approach that would see Europe become socially and economically planned and engineered to be self-sufficient and therefore minimizing interaction with the outside world. The final image is one of *Eco-Europe*, an ecologically based system that is regulated and controlled to minimize the need for mobility. It would be inherently local in its focus. While none of these necessarily represents Europe's transport future, these are the limits within which a solution to that future will be found.

Unlike the European paper, the American paper did not seek to solve a current problem, but rather sought to identify research that needed to be undertaken simply because we do not have a firm understanding of current or anticipated future transport problems.<sup>7</sup> The approach taken in this paper was to identify major research problems in the areas of transport systems (intermodalism, infrastructure, safety, security, congestion, environmental impacts, fuel availability, accessibility impacts and system valuation); traffic flow attributes (trip characteristics, full costing of travel, travel market saturation, substitution of communication); trip-maker attributes (changing attitudes, trip budgets, family structure and travel demand, age and trip-making); and, methods of analysis (project evaluation, new approaches to modeling travel, dynamics of space-time modeling and visualization, and virtual reality). The paper went on to place all of these research problems under the umbrella of sustainable transport, which may be defined by paraphrasing the Bruntland Report, as transport that meets the needs of the present without compromising the ability of future generations to meet their own transport needs.<sup>8</sup> Although

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<sup>6</sup> Peter Nijkamp and Marina van Geenhuizen (1997), "European transport: challenges and opportunities for future research and policies," *Journal of Transport Geography*, Vol. 5, No. 1, pp. 4-11.

<sup>7</sup> William R. Black (1997), "North American transportation: perspectives on research needs and sustainable transportation," *Journal of Transport Geography*, Vol. 5, No. 1, pp. 12-19.

<sup>8</sup> World Commission on Environment and Development (1987), *Our Common Future*, Oxford: Oxford

generally viewed as an environmental concept, sustainability is actually much broader than this and as a result a solution to any of the major transport problems noted above would be a move toward sustainable transport.

Attendees at the Arlington workshop critiqued both papers and expanded on the content of each. Some viewed the problems as far too numerous and difficult to understand, others argued that sustainability was unattainable, still others viewed Europe's transport problems as too parochial and noted that they hardly constituted a research agenda.<sup>9</sup>

The workshop identified four major criteria to be used for selecting cooperative transport research themes. These included (1) selection of truly international issues; (2) common or critical methodological concerns; (3) feasibility and tractability of the research program; and (4) a major emphasis on long-term issues. It was felt that "international issues" (i.e., issues that cut across the transportation field and were of interest to the international community of researchers) should be the focus of any joint activity. These include international trade and transport flows, but are NOT limited to that topic. Comparative case studies which examine a transport problem and how it is managed in a variety of different (economic, cultural) settings using different mechanisms could be of great value. Further, the research topics and problems analyzed should be common to both sides of the Atlantic even if the institutional and cultural contexts differ. Within this perspective fundamental issues rather than operational differences are of major concern. With respect to "methods of analysis," software, data bases and procedures for deriving valid and reliable findings need to be comparable. Here it is these methodological considerations, including modeling, that need to be the research focus rather than policy assessment or analysis. In order to engage in cooperative projects, the research programs undertaken should be "tractable" and executable, with a limited duration and capable of providing measurable results. There is a need to focus on limited but concrete contributions to knowledge in this area of transportation research. Research topics identified should be of fundamental "long range and enduring interest" and offer the potential for new insights and new contributions by interdisciplinary and international teams of social scientists.

With these criteria in mind and the wide range of research issues identified in the various papers, the workshop teams developed a set of five research clusters.

I **Sustainable transport** is a central theme that includes environmental, economic and financial sustainability as well as social and political sustainability. Sustainable transport is limited by the physical environment and the kinds of technology available as well as by individual preferences and social conditioning. This theme is enduring and long lasting but it should be possible to identify specific, tractable projects within this larger context. Issues of data base considerations, the quality and dependability of existing models, valid methodologies for evaluation and comparison, different

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University Press.

<sup>9</sup> Twenty-nine of the prepared statements appear in the *Journal of Transport Geography*, Vol. 5, No. 1, 1997.

physical environments and local geographies as well as socio-economic differences mean that international cross comparisons could be of considerable value.

II **Social change** is both affecting and being affected by transportation system dynamics. The rise of the service sector implies a dematerialization of some of the typical intersystem flows as information replaces goods in the transportation exchange process. However as transport and travel costs decline, what does this mean to urban patterns of spatial organization, i.e. the compact city versus the urbanized deconcentration and edge city developments? What options exist for alternative urban patterns and what role will transport play as a leader or follower in these reorganized land use patterns? What does this new transport and communication pattern imply for the definition of "work" and "work place?" How will that affect labor force participation by gender and age? What does this imply in equity terms and in terms of family organization? How will the interaction between transportation and societal change interact with each other (i.e., behavior and the built environment)? If technological change and social change quicken what does that imply for long-term, less-flexible transportation infrastructure? How do we create reusable, recyclable and flexible infrastructure? Are there fundamental cultural differences in the role of transportation in different societies for work, social or production purposes; or are these differences only economic and socially stratified within a society; or are they both different across as well as within societies?

III **Globalization** is creating convergence in productivity, labor-capital ratios, returns on capital and in terms of social and economic goals within the industrialized world. What aspect of this convergence is due to communication versus transportation? How have commodity flows shifted in the past few years as increasingly direct linkages develop between places of production and consumption? What is the cost of transportation in terms of the value of traded commodities? What implication is there for the shift from "hub and spoke" distribution systems to "point to point" systems for transport network management and the traditional urban hierarchy?

IV **Information and communication technology** is a central part of Telematics in Europe or Intelligent Transportation Systems (ITS) in the US. Operationally it incorporates advanced technology into vehicles and externally into infrastructure support of vehicle performance, but little is known about the behavioral response of motorists to its use. Issues about information overload and driving decisions are poorly understood but the broad integration of this technology into a wide array of transportation systems is moving forward very quickly. Issues of social values such as privacy versus convenience are areas of potential trade-offs and areas of new organizational forms for management of these concerns.

V **Institutional considerations** in transportation management and support are of central concern. Decision processes vary according to patterns of public-private cooperation in different countries. This represents both differences in patterns of government organization, history and experience with private sector entities, public expectations and measures of efficiency and effectiveness of organizations. Differences exist between Europe and the US in terms of mass transit and automobile usage as well as differences in freight management. New organizational forms are emerging in Europe in terms of intercountry management of aviation and freight flows while the US is looking



for new and efficient ways of handling these decentralization issues. Public expectations for increased mobility with higher incomes impact public demand for higher environmental quality which also tends to be upper-income sensitive. Management of high-intensity transportation corridors such as those through parts of Germany and The Netherlands and on the East Coast of the US present parallel institutional concerns for management of multi-jurisdictional cooperation.

These broad issues incorporate technical support considerations in selection of infrastructure technology for investment, operations and maintenance of transport technologies as well as decision processes for public participation and information management. Sustainability is the watch word that links many of these concerns.

### **The Strasbourg Workshop: Development of the Agenda**

Using these five themes, research teams consisting of one North American and one European were asked to prepare short integrated white papers on each research cluster for a second workshop that was held at the headquarters of the European Science Foundation in Strasbourg, France, in October of 1996. Each of the papers had discussants who prepared comments on the drafts presented. The following section summarizes the five papers prepared and revised based on the comments of the discussants.

#### **Sustainable Transport** <sup>10</sup>

Discussions of transport sustainability often take the very narrow view that current transport is non-sustainable due to its contribution to global warming and its negative impacts on air quality. Occasionally some ecological impacts are also recognized. This is typical of a recent report by the Transportation Research Board of the National Research Council.<sup>11</sup> Sustainable transport does impact these environmental sectors, but solving these emissions related problems will not suddenly make our current transport modes and systems sustainable. There are other dimensions to transport sustainability that must be recognized.

Current transport systems are not sustainable for several reasons. First, they rely on petroleum resources that are finite and by some projections will not last beyond the half-way mark of the next century. This seems like a rather important point for any discussion of sustainability. Many of the alternatives to this fuel that are easily available are also fossil fuel - based, e.g., natural

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<sup>10</sup> Based in part on David L. Greene and Michael Wegener (1997), *Sustainable Transport*, @ *Journal of Transport Geography*, Vol. 5, No. 3, pp. 177-190; and, W.R. Black (1996), *Sustainable transportation: a U.S. perspective*, @ *Journal of Transport Geography*, Vol. 4, No. 3, pp. 151-159.

<sup>11</sup> Committee for a Study on Transportation and a Sustainable Environment (1997), *Toward a sustainable future: addressing the long-term effects of motor vehicle transportation on climate and ecology*. Special Report 251, Transportation Research Board, National Research Council, Washington, DC: National Academy Press.

gas or methane produced from that source, and these will also contribute to the environmental problems noted. Second, motor vehicle crashes resulting in death or serious injuries suggest that this is also a negative contribution to transport sustainability. Third, the recognition that many cities currently have congested transport facilities and that these will only become worse in the future also argues for a broader definition of this term. In effect, we must look beyond the current pollution and emission problems as being the cause of non-sustainability in the transport sector.

The physical sciences and engineering may solve the emission and pollution related problems. In the absence of petroleum, they are already aware of the alternative fuels and/or power sources that will be necessary. They may further improve the safety of motor vehicles beyond the current seat belts, air bags, and the like. Some planners may also argue that additional capacity will eliminate the congestion problems, but these will be in the minority. For the most part these are technological solutions, but even if they were all operational they are not the answer to sustainable transport.

We are at a point where transport sustainability is crossing a very fine line between being a problem of the technical sciences and becoming a problem of the social sciences. The shift to alternative fuels will create economic problems and dislocations that are not well understood. We know that alternative fuels have not been developed because of the extremely low price of gasoline that makes all other fuels non-competitive. We know that young men are reckless and the major contributor to automotive accidents, and that the aged in some cases should not be driving. We don't know how to alter human behavior that creates risks. We know that if we remove the physical factors that may contribute to accidents, then the accidents simply migrate to another location on the highway, but we don't know why this occurs. We also know that congestion is most often caused by excessive travel demand being satisfied during the morning and evening peak travel times, but we have not been very successful at spreading out this demand. These are among the problems of the social sciences and we must recognize that this is the area that we are moving toward when it comes to questions of sustainable transport.

The above are only suggestive of the social science-oriented research questions that must be answered by research. To some these may appear to be policy questions, but they are not. Policy is simply one way of implementing research findings. If we want to decrease motor vehicle emissions we may want to place a tax on gasoline that covers many of its external costs and at the same time discourages driving. That is a policy decision. The economic researcher knows that the demand for travel is somewhat inelastic with regard to increases in fuel prices, but believes this question needs to be researched further. He/she may also believe that we must do more research into valuing the costs of externalities associated with transport if these are to be used as the basis for a tax. The sociologist may be more concerned with equity issues generated by the increase in the price of fuel, with the eventual impact this could have on the cost of public transit, or with the possibility that such price increases may make daycare unaffordable for many lower income workers. Certainly policy may be developed in these areas, but to do this in the absence of needed social science research is reckless at best.

## Social Change and Transport <sup>12</sup>

Social change as it affects and is affected by transport is a broad topic. The discussion that follows breaks this change into three broad areas that seem primary to this topic. These are urban decentralization, household and population related change, and workplace - related changes.

### Decentralization

There were several major trends during the twentieth century that changed the way in which U.S. cities are socially, economically, and spatially organized; the compact cities of the 1900s were replaced by outward growth resulting in lower densities. These changes were initiated in most cases by the provision of rapid transit and street cars. Suburbanization followed World War II, and was made possible primarily by the automobile. This frequently led to additional traffic from the periphery and necessitated the construction of arterials to the city centers. City centers were still important at the time. Soon these highway corridors filled with traffic and this necessitated the identification of multiple centers for the larger cities; places that were more accessible, or at least perceived to be more accessible. The social and economic impacts of these processes are well-documented in the literature.

These decentralization processes also stimulated changes in travel behavior including increases in the level of automobile ownership, increases in the annual mileage driven stemming not just from longer trips, but from taking more trips, and more trips alone. Transit ridership was falling quite significantly due to the inability of operators to serve low density suburbs without cutting back on the quality and quantity of service. Attempts by the public sector in the U.S. to rescue this service were successful only in keeping transit available, but the transit share of the travel market has continued to decline nationally.

European cities have also seen a decentralization trend, but the cities are more compact to begin with and peripheral land use is controlled more tightly. However, auto ownership is lower (about 2/3 the U.S. level), motor vehicle trips are fewer, and transit remains a reasonable alternative mode. However, auto ownership is increasing more rapidly in Europe than in the U.S. at present.

Travel has also been impacted by the suburbanization of jobs and changes in the patterns of the journey to work because of this. Increases in activity spaces have necessitated more travel as well as the creation of edge cities which are perceived to be more accessible even though they may result in more miles driven.

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<sup>12</sup> Based in part on Genevieve Giuliano and Andrew Gillespie (1997), A Research issues regarding societal change and transport, @ *Journal of Transport Geography*, Vol. 5, No. 3, pp. 165-176.

## Household and Population-Related Changes

There have been a host of household and population related changes that have implications for travel behavior. Among these are growth in the elderly population, the decline of the nuclear family, and the polarization of incomes.

By the end of the first decade of the 21st century we will have a large segment of the population entering retirement. This group of elderly in the United States has based its mobility almost entirely on the automobile and this raises questions regarding the potential impact of this large elderly population group driving motor vehicles since they do have a higher than average crash rate. It is unreasonable to assume these individuals will embrace traveling by public transit or be willing to move into central cities. This may also be a problem in Europe, but of less magnitude, since there is a tendency to remain among family members or to migrate to small villages upon retirement. The latter acts generate less travel demand.

While the reasons behind the decline of the nuclear family are not transport based, high mobility levels have reduced some of the personal costs of breaking away, and the changes created by this trend have significant transport implications. Foremost among these changes is the increase in single parent and single-person households. We have seen little research on these family groups in the U.S. or Europe. In the case of families breaking up that have children, there are several travel demand increases that must result due to what could be called the loss of family-based economies of scale. In addition, these situations may generate additional work trips as both single parents must participate in the workforce. We have little understanding of the total impacts of these changes, but it does appear to be a growing segment of the travel market.

Income disparity has resulted in the lower income segment having lower levels of mobility since they are frequently carless and reside in central cities that have less than adequate levels of public transit. In particular, with the out-migration of many economic activities we find these activities are inaccessible to lower income residents of central cities since transit is oriented toward central cities and not away from them. Jobs remaining in the central cities are for lower wages and this basically prevents lower income workers from breaking out of this situation. This is less of a problem in European cities due to welfare programs, labor market regulation and high levels of transit service.

## Workplace Related Changes

Perhaps the major contemporary change in the workplace that has implications for travel demand is the use of information and communication technologies (ICT). Its most talked about form is teleworking or telecommuting. There was some concern that rather than being a substitute for travel, this practice might actually result in more non-work travel. Some studies suggest that there is actually a reduction in total travel, but the practice is relatively new and these reductions in travel could disappear with time. Even if they don't, we must not expect too much of telecommuting. While the U.S. Department of Transportation expected 10 percent of all work trips would be replaced

by telecommutes by 1998, the actual number is somewhere between 1 and 1 1/2 percent. The situation in Europe is not much different than the U.S. experience, but there has been appreciably less research there and we are uncertain to what extent some of the problems observed in the U.S. are also occurring there.

The most promising area of comparative research appears to be related to these workplace related changes due to ICT. First, little is yet known about the nature of workplace related changes, or about how these changes are affecting location and travel patterns. Second, as these changes continue and possibly increase in intensity, particularly increases in the adoption of ICT, its impacts will increase. Third, these changes are fundamental; every aspect of the work experience is undergoing great change. The magnitude of these changes is comparable to the increasing role of women in the work force during the past few decades. This massive entry of women into the labor force generated significant changes in household characteristics, car ownership, location and travel behavior. Studies of these changes should generate comparative studies that are particularly fruitful.

### **Globalization**<sup>13</sup>

In its simplest form, globalization refers to the increasing geographical scale of economic, social, and political interactions. Surprisingly, with a few exceptions, the principal conceptualizations of globalization either ignore completely any reference to transportation or make only implicit linkages. Such neglect may relate to the apparent invisibility of international transportation and communications -- much of it occurring over oceans and in the air, transmitted by under water/ground cables, or by remote satellites and electromagnetic waves. Yet, some inconsistencies in discussions on the socio-economic consequences of globalization may be explained through greater understanding of transportation and related space-adjusting technologies. The transport industry is a major beneficiary of recent technological developments and a central contributor to this more globalized economy. It acts as a catalyst for reduced restrictions on international trade, promotes new technologies and markets them on a global basis, seeks both national and international policy measures to support expanded transport investments, and often discourages regulatory measures to internalize the negative social and environmental costs associated with transport practices.

Space-adjusting technologies, such as transportation, function to produce accessibility. But, as Sheppard observes, they differ fundamentally from other forms of production. They produce flows linking places, not goods in places. Their product (accessibility) is necessary to the successful realization of any economic activity . . . [and] must be consumed between the production and consumption of all goods (including itself).<sup>14</sup> These distinctive characteristics have been largely ignored in the literature on globalization, yet they provide the foundations for economic

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<sup>13</sup> Based in part on Donald G. Janelle and Michel Beuthe (1997), "Globalization and research issues in transportation," *Journal of Transport Geography*, Vol. 5, No. 3, pp. 199-206.

<sup>14</sup> Comments of Eric Sheppard at the National Science Foundation-European Science Foundation Workshop on Transport Research, Strasbourg, France, October 7, 1996.

transformations at all geographical scales of organization. Understanding the link between globalization and space-adjusting technologies should be a high priority for scientific research. Examples of related research questions include the role of international multimodal carriers, transport network restructuring among world cities, and the integration of telecommunications and transportation systems through the use of modern logistical systems.

Broad generalizations about how the demand for transport responds to globalization might reasonably include: longer and more customized transport linkages; greater sensitivity to the timing of connections, arrivals, and departures; expanded reliance on communication and computer networks, greater standardization of technologies and procedures, and speed of movements and transactions.

### Globalization and the Vulnerability of Transport Systems

Globalization exposes transportation to severe vulnerability, often at short notice. For example, high levels of automobile and petroleum dependence, which are undergoing world-wide diffusion, place transportation at risk from political/economic boycotts and embargoes. The immunization of transportation from such debilitating dependence is not likely, but research into the politics of such actions is needed to suggest ways of mitigating impacts when they do occur. Similar arguments are possible regarding the security of passengers, freight, and transport infrastructure; since transportation is a frequent target of terrorist threats, its use and design must be cognizant of the broader international political environment.

Even the sensible realization that global environmental problems (such as air pollution and global warming, and marine discharge of waste) warrant global solutions exposes current transportation systems and their dependent economies to serious problems. For example, implementation of global standards on fossil fuel use will impact on the price of petroleum, with potentially significant ripple-effects on land use, transportation behavior, and resource substitution. Modeling such processes at different spatial scales is an important challenge for researchers that will yield critical information for decision makers. In addition, preemptive strategies to restrict land use patterns to offset fossil fuel dependence or to encourage greater efficiency in fuel use warrant continued research and policy consideration.

Internationalization in the trade and transport of toxic/hazardous products and waste is an issue that touches on inequalities in North-South relationships and in core-periphery relationships within countries. The nature of this problem and the comparative ability of states to respond cooperatively on an international basis are areas of growing concern. For transportation, it entails the process whereby such trade develops and the related problems of finding disposal sites and appropriate routings that minimize the vulnerability of population and property.

### Transportation and the Dematerialization of the Economy

Transportation has served as the vehicle for intensifying mass consumption of resources and

goods beyond subsistence levels for many centuries. Globalization of commodity and resource trade reinforces this role. To this extent, since transportation and consumerism are products of mutual causation, transportation must figure prominently in the changing attitudes and practices regarding consumerism.

To the extent that future economies might be based on a higher ratio of information-based goods and services to material resources (dematerialization of the economy), the relative extent of transportation input to final production might be reduced. Also at issue is the possibility for advanced design technologies to reduce the reliance on material resources, thus lessening transportation requirements in keeping with principles of environmental sustainability. Related issues of waste recycling and requirements to manage the production cycle through the complete range from production to the final treatment of discards and waste have important implications for transportation and warrant consideration in any comprehensive research agenda.

While mobility is a central requirement for large regional and global economies, there is the risk that its resource demands and pollution consequences will contribute to the environmental unsustainability of global industrialism. One of the main issues regarding globalization is its repose on relatively cheap transportation. Taking into account the externality costs of environmental and social consequences, and the limited availability of energy resources, is transportation too cheap? How would a "global optimization" that accounted for full costing of all externalities alter current geographical patterns of economic activity? These questions broaden significantly the concerns for global economic restructuring (and transportation) beyond issues of technological and organizational response for efficiency and competitiveness. There is need to treat both social and ecological forces as parts of any model for a sustainable transport system in the global political economy.

### **Information and Communication Technologies**<sup>15</sup>

There has been a virtual explosion in the development and availability of new information and communication technology (ICT) for both private and public individual travel. However, we know relatively little about how these new technologies will affect individual travel behavior. How will individuals respond to these new technologies? To date research on the use of real-time information systems, for example, is based on simulations, but these simulations indicate that user responses will vary with context and with market penetration.

The use of ICT is often related to an increase in the globalization of communications and trade. The use of ICT networks, e.g., by undertaking video conferences and by using decentralized telecenters, may substitute for business traveling by reducing the number and/or length of business related trips. The quality of business trips, even if this option does not necessarily decrease the number or length of the trips, may also be increased. Previous case studies have suggested that while

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<sup>15</sup> Based in part on David Hodge and Heli Koski (1997), Information and communication technologies and transportation: European -US collaboration and comparative research possibilities, *Journal of Transport Geography*, Vol. 5, No. 3, pp. 191-197.

the use of teleconferencing decreases the average conference trip length, it can increase the total amount of travel in firms as a higher number of people attend meetings (at two or more sites) when video conference facilities are used. Also, some researchers have pointed out that individuals' willingness to travel (or the status value of business trips) and their need for face-to-face interaction with the other people may also hinder use of ICT for substituting business related trips. Indeed, the use of communications technology for initial interactions may stimulate the need for more travel, not less travel. A continuous provision of fancier, smaller and more efficient means for distant work and communication, e.g., portable computers, mobile phones, communicators - hardly reduces incentives of the business travelers to move.

The impact of commercial or business traveling on the use of transportation networks, especially on the length of the business trips, will depend critically on the degree of globalization of international trade which will take place due to use of ICT. Thus, a critical research topic is what the degree of globalization due to use of ICT will be. This issue might be explored by undertaking comparative studies of American and European firms on their anticipated future use of ICT in international trade. Another notable issue that deserves attention in these case studies is to identify the type and order of magnitude of incentive that firms require in order to substitute part of their business trips by ICT based communication. It should also be asked how much of business trips has been/ would be substituted by ICT. Based on this information, a theoretically based cost-benefit analysis might be undertaken in order to evaluate how reasonable from the global or sustainable point of view it would be to support or provide incentives to the firms to substitute ICT for business trips.

Developing an electronic market place, in particular an increasing commercial role for the Internet, raises questions of the potential impacts of electronic commerce on transport behavior. The previous experiences of mail order retailing might provide some hints of the potential effects of electronic home shopping on transport behavior. In what respects is the electronic market place perceived differently from mail order retailing by consumers and to what extent might these differences cause different transport effects?

It seems likely that the availability of ICT applications that can be used as a means to assist industrial traveling and trade, e.g., real-time electronic transmission of information and data, will increase both cross-border freight transport and the transport demand on national transport networks. These changes will provide both theoretical challenges to our understanding of barriers to networks, but also to the role of institutions in facilitating the deployment of ICT across borders. Moreover, international trade will become a tempting opportunity to an increasing number of firms who can extend their market area over national borders with small marketing costs via the Internet. It seems theoretically possible, then, that firms will distribute their products to a wider geographical area, convey smaller sales batches, and make more trips for transporting their products to customers. An increase in industrial travel will likely create additional capacity burdens to cross-border traffic and to local, national, and international transportation networks. It may also create a remarkable demand for the advanced transport telematics if firms are willing to be pay for the efficiency and reliability of their transport operations obtained by use of ICT and if institutional structures have been created to facilitate their use. The demand for transportation networks in a single country and the advanced ICT



services provided for industrial travelers will then be of critical importance in order to handle traffic loads safely and efficiently.

Finally, the historic connection between transportation and urban form is well understood, at least in a descriptive sense. The connection between information and communication technology and urban form is proving to be more difficult to understand, and extremely difficult to forecast. Yet nowhere will the real, and everyday, impacts of information and communication technology be felt more than in the nature of urban places. Collaborative and comparative social science research into measuring accessibility, the distribution or redistribution of urban activities, equity and other social implications, and scenario building may increase our understanding in this area as well.

### **Institutional Considerations**<sup>16</sup>

Transportation is often considered in terms of the functional infrastructure that supports the movement of people and goods. There are however, a number of institutions ranging from law and regulations to informal conventions that support transportation systems. These institutions are defined by and maintained at base by culture and values.

Institutions in their broadest definition are social rule structures with associated standing patterns of behavior and procedures. For example, at a given time societies have rules (formal/statutory and informal) that define accepted behavior and action patterns for institutions such as property rights, provision of infrastructure (private vs. public), management practices, governance, the role of markets, and so on. Institutions are sometimes confused with organizations, e.g., universities vs. higher education; governments rather than governance; associations vs. influence circles or structures; and companies vs. markets or competition. Here institutions are defined in terms of the broader definition. Concern thus rests with institutions defined as rule structures not as specific organizations. The following summarizes the research agenda items that merit institutional-related research.

### **Production Processes**

Changes in manufacturing process have necessitated a greater integration of the logistics that support and make possible the compression of time in the value delivery chain. There is a continuing need to integrate better the various logistical components that are required to support increasingly shortened product life cycles and just-in-time production and distribution practices. There is thus, a need to improve models used to test, evaluate and simulate highly complex and integrated logistics/transportation/production systems. Research into improved modeling of logistical integration with particular emphasis on institutional impediments is needed to enhance the productivity of transportation infrastructure and related provision of products and services.

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<sup>16</sup> Based in part on Roger R. Stough and Piet Rietveld (1997), *Institutional issues in transport systems*,<sup>@</sup> *Journal of Transport Geography*, Vol. 5, No. 3, pp. 207-214.

## Governance and The Regulatory Environment

The broadening of participation in transportation decision making has seriously slowed and complicated the process. New decision support tools are needed to help shorten the decision time and improve stakeholder satisfaction. Research into the development of transportation models for supporting the decision process and, therefore, the governance environment within which decisions are made is needed. Research is also required to learn how to use such models to improve decision quality, for example, by faster than real time simulations and rapid feedback of the effect of alternative policies to decision makers.

## Transportation and Benefit Estimation

With the participation of a broader range of stakeholders, estimating the benefits and costs of transportation improvements has become increasingly more complicated. Simple cost/benefit approaches are insufficient to estimate the contributions or costs of externalities such as environment, competitiveness, economic, and equity effects. Research is needed to develop, test and evaluate new tools for estimating the benefits of transportation investments and their alternatives.

## Managing Transportation Systems

Management structures for transportation systems tend to be locked into a fairly inflexible, rigid and vertical organizational structure. This complicates their ability to manage the system in a context of multiplying stakeholders and interests, and one that increasingly requires expertise in the use of computer and information technology. Research is needed to better understand the dimensions and depth of this management problem. Research is also needed to develop educational programs to help transform existing management structures into ones that are more flexible and adaptable to change.

## Technology and Transportation

Computer and information technology are increasingly becoming a cornerstone for improving transport capacity while at the same time offering the potential of greater stakeholder support and agreement than for traditional capacity expansion investments. Deployment of these new technologies is still, despite a fairly widespread range of demonstration projects, in a nascent stage of development. Institutional impediments, including intergovernmental relations, societal concerns such as privacy, equity, role of the public and private sectors, user acceptance and legal/liability issues, are still not well understood. Research into these issues is needed to support a more efficient and effective deployment of ITS and to evaluate the benefits of accelerated deployment. There is also a great opportunity to investigate the role of standards and standards development as both facilitators and bottlenecks in the spread and adoption of these new technologies.

## Territorial Issues and Institutions

There is a growing need to create a more seamless flow of goods, services and people across national borders as illustrated by the efforts of the EU, NAFTA and other multi-state trade agreements. There are however, many highly resistant institutional impediments in the way of improved trans-border flows. These range from inter-governmental cooperation, treaty and trade-agreements, multi-national standards, taxation and the coordination of all of these. Research is needed into the nature of institutional impediments to improved trans-border flows.

## Institutional Differences in Transport Policies

Considerable differences exist among countries in the ways they try to solve transport problems. These differences illustrate that public transportation policies are not created simply in the name of efficiency maximization, but that they also depend on cultural and value differences. Research into the nature of these cultural and value differences in transport policy formation would provide significantly improved insight into the genesis of cross-country differences in transport policy.

## New Actors and Stakeholders

Here an expanded array of interests and stakeholders has appeared in transportation policy and decision making over the past decade or so. There are, in addition to the new interests mentioned, interests concerned with the environment, the disabled, the poor, and other actors that have or are increasingly contributing to transportation decisions. These include auto manufacturers, the aviation industry, insurance companies, recreation and tourism interests, and the driving public. Research is needed to better understand the role of these groups in the formation of transport policy and investments made in transportation capacity improvements.

These institutional contexts are critical in analyzing social science questions. While abstract theoretical treatments of a transport problem may help us to understand its basic dimensions, examinations of current social science - oriented transport problems must include the institutional context within which they exist if we are to solve them. The former may yield interesting results, but the latter may yield insightful answers.

## **The Lugano Workshop: Refinements of the Agenda**

The final workshop was held in Lugano, Switzerland in November of 1997. The earlier workshops had involved geographers, sociologists, planners, engineers and economists, and there was an attempt with the Lugano workshop to broaden the social science orientation of the research program by bringing in other social scientists and engineers, who had an interest in social science questions. There was also a desire to hear the views of additional scholars who in some cases had not been heavily involved in the activities of the group earlier. The new scientists were asked to identify major research themes related to the broad areas of social change and sustainable transport that they thought would be worthy of joint transatlantic research. Documents from previous sessions

were distributed to the new attendees prior to the session to familiarize them with accomplishments to date. Some of the insights provided by the Lugano participants were quite valuable.

Speaking on sustainability in urban transport, Martinotti noted that transport and mobility over time have changed urban area populations from inhabitants and workers, to commuters, to users and finally to businessmen who only visit the city. The inhabitants are becoming the smallest groups and in many cases the least significant economically. He notes:

the entire philosophy of local government is based on various degrees of self-governments by city dwellers. If this population is going to become increasing irrelevant from the numerical and economic points of view, one serious and far reaching consequence - which is already behind many manifestations of the urban crisis - is a *de facto* disenfranchising of the urban dweller. Local governments are elected by residents, but the economic interests of the metropolis are increasingly dependent on populations not politically accountable from the point of view of the city itself.<sup>17</sup>

The difficulty of combining increasing physical mobility with an improved environment was addressed by Falkemark. He sees this problem not as technical, but as being associated with the distribution of power. Simply put, those groups in society which prefer an increased mobility are commanding greater power resources than those groups which emphasize >greener= values.<sup>18</sup> He also suggested the need to study alternative philosophies of mobility, noting that the current philosophy is economically derived from the writings of Adam Smith, and as such favors rapid economic growth derived from extensions of transport to increase the size of markets. It might be of interest to have a philosophy of slow mobility. What would be the advantages of such a philosophy?

Gillespie sees social change occurring in a direction that is incompatible or at least in conflict with the paradigm of sustainable transport.

All the evidence seems to point in the direction of ever-enlarging daily activity spaces and systems of economic organisation, which necessarily seem to embody high mobility characteristics and very substantial travel generation (not more journeys, but journeys over longer distances). This apparent close positive relationship between social change and travel generation poses a number of challenges to society; these include *inter alia* environmental challenges (pollution, congestion, safety, etc.); social

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<sup>17</sup> Guido Martinotti, 'The city of the future: remarks for a possible social science research agenda on the study of urban mobility.' Prepared for the NSF/ESF Workshop in Lugano, Switzerland, November 3, 1997.

<sup>18</sup> Gunnar Falkemark, 'Some comments on >Social Change and Sustainable Transport (SCAST).-' Prepared for the NSF/ESF Workshop, Lugano, Switzerland, Nov. 3, 1997.

equity challenges (since we know that substantial minorities are not sharing in the mobility benefits enjoyed by the majority); economic challenges (such as, for example, the implications of internalising the currently external social costs of high mobility lifestyles and economic forms); societal and psychological challenges associated with the long-term implications of high mobility; and regulatory challenges (associated with the potential for regulation to accomplish changes in behavior which lead to more sustainable transport usage patterns).<sup>19</sup>

A body of research in transportation is concerned with modeling behavior and much recent research has focused on behavioral approaches. According to Sperling in the transportation lexicon, behavioral analysis means using the individual or household as the unit of analysis; it does not imply a true behavioral inquiry, one grounded in the behavioral sciences (especially psychology, anthropology and sociology). Indeed, most behavioral research in transportation is by engineers and mathematical economists.<sup>20</sup>

In addition, we do not understand coping and adaptive strategies that might be employed in response to constraints (e.g., congestion) and opportunities (e.g., new types of vehicles). We are unable to forecast markets for technologically new vehicles, new fuels, or new systems (e.g., shared vehicles). How can we better understand these situations?

It is recognized that transportation -related research has tended to focus on the behavioral side (individuals and households as defined above) of transport as opposed to the social side. In no case is this more evident than in transport planning, where the concern has been identifying and providing facilities that meet individual needs, as opposed to societal needs. Hanson observed

in this context the value of travel time became a dominant element in assessing the costs and benefits of proposed transportation facilities, and increased speed became the number one goal. When we are challenged to think about how transportation may become more sustainable, we need to shift thinking from the individual/household level to the level of society as a whole. Social and behavioral science will have to expand its horizons accordingly.<sup>21</sup>

In summary, the Lugano workshop confirmed the importance of the social science - oriented

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<sup>19</sup> Andrew Gillespie, Comments and priorities for research. Prepared for the NSF/ESF Workshop, Lugano, Switzerland, Nov. 3, 1997.

<sup>20</sup> Daniel Sperling, Needed social and behavioral science contributions to transportation research. Prepared for the NSF/ESF Workshop, Lugano, Switzerland, Nov. 3, 1997.

<sup>21</sup> Susan Hanson, Will we know it when we see it?: can basic social science research put us on the road to sustainable transportation. Prepared for the NSF/ESF Workshop, Lugano, Switzerland, Nov. 3, 1997.

transport research program and the research agenda that had developed conceptually in the spring of 1996. In addition, comments delivered at that workshop actually broadened and refined the scope of the research agenda bringing in perspectives from other social sciences and disciplines that had not been considered earlier. There can be little doubt that such a social science program is needed. The comments received make it very clear that the United States and Europe are moving in a direction with regard to transport that is not sustainable. This movement is encouraged by society at large and we need to understand the basis for it. We also need to understand the full range of social impacts that can, and most likely will result from a desire for even higher mobility levels in the future.

### Chapter 3 The Berkeley Conference <sup>22</sup>

Under the joint sponsorship of the European Science Foundation (ESF) and the National Science Foundation (NSF) in the U.S., a conference was held addressing research needs in the general areas of Social Change and Sustainable Transport (SCAST) at the University of California - Berkeley, from March 10 through the 13<sup>th</sup> of 1999. Local sponsors for the conference were the University of California Transportation Center (UCTC), the Institute of Transportation Studies (ITS), and the Institute for Urban and Regional Development.

Co-chairmen for the conference were Professor William R. Black (Indiana University, USA) and Professor Peter Nijkamp (Free University - Amsterdam, The Netherlands). Participants in the conference were academics from Canada, the United States, England, Germany, France, Sweden, The Netherlands, Italy, Israel, Belgium, Denmark, Finland, Switzerland, and Ireland. The participants numbered about 108 and were selected based on the submission of a paper or research proposal that addressed the general topic of social change and/or sustainable transport. Approximately 250 scholars submitted proposals to the conference planners.

The conference began March 10 with welcomes from Martin Wachs of the UCTC and William L. Garrison of the ITS. Garrison reminded the group of W.S. Jevon's 1865 work, entitled *The Coal Question*, in which the author had forecast the end of coal as an energy source, perhaps cautioning those in the audience concerned about the life of petroleum not to go too far beyond their data. He was followed by Jeff Fenstermacher of NSF and John Smith of NSF who summarized the background to the conference and offered words of encouragement and support for the conference.

The remainder of Wednesday was devoted to plenary sessions. A paper by Marina van Geenhuizen (University of Delft), Peter Nijkamp, and William Black sought to place all research on points of a triangle involving behavioral, technological and policy research (see Figure 1). Although not the objective of the conference chairmen, the triangle became an organizing vehicle for the papers presented during the four days of the conference.

A second plenary session summarized the various focal points for research under SCAST. These papers looked at the title topics, social change and sustainable transport, as well as the role of information and communication technology on transport, globalization's role, and the role of institutions on transport operations. These are general research areas identified during previous meetings and workshops of transport researchers from Europe and North America sponsored by NSF

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<sup>22</sup> This section is based in large part on AA transatlantic route to sustainable transport, @ *ESF Communication: A Journal of the European Science Foundation*, Summer/Autumn 1999, No. 40, 20-21.

and ESF.

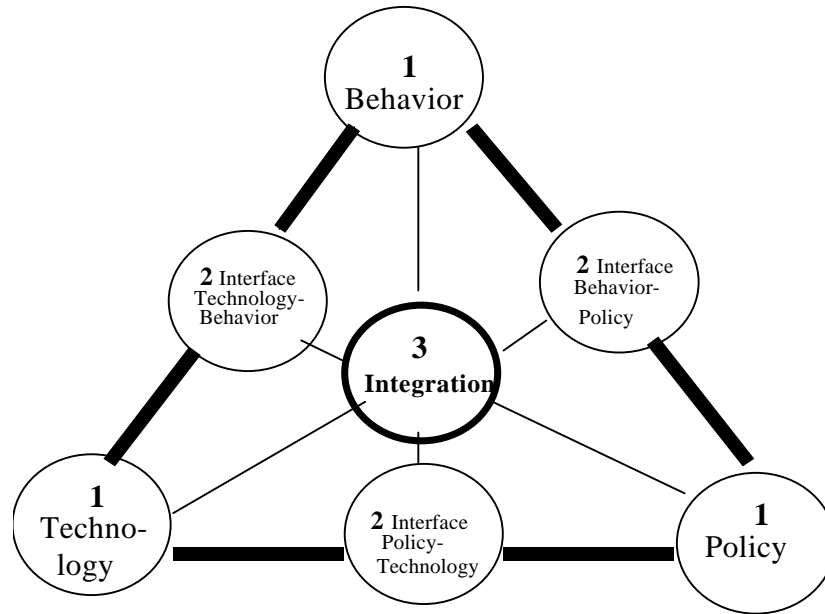


Figure 1. SCAST Triangle

A third plenary session sought to place the conference firmly in the social science realm with presentations by Manuel Castells (University of California - Berkeley) and Guido Martinotti (University of Milan), two of the most revered sociologists in the world today who addressed the general topic of social change as a driver of mobility.

The final plenary session of the day had presentations by Martin Wachs, Peter Jones (University of Westminster), and Melvin Webber (University of California - Berkeley) on the need for interdisciplinary research in addressing transport and social trend research. Wachs looked forward in time and concluded we will travel at a wider variety of times and that travel will be more broadly distributed in space and time, and that dispersion in space and time will be one of the major factors that will allow us to manage an enormous increase in travel volumes without an enormous increase in congestion. Peter Jones viewed actions toward sustainability in the UK. Webber reviewed the barriers to sustainability concluding that only technology could solve the problems he saw, and this stimulated some lively discussion by attendees.

On the second and third day of the conference the participants had a choice of two concurrent sessions. Sessions were presented on past, current, and future research involving transatlantic research teams. A major SCAST theme is that there is merit in such comparative research beyond what could be derived from case studies and the papers presented seemed to certainly support that notion. Sessions on car culture, auto dependency, and new views of mobility were countered by sessions on women's travel and wasteful commuting as reflections of the role of



life styles. Comparative studies of travel and transport planning were also presented with significant questions raised about the merits of planning models in North America and Europe.

The ageing population brings a set of mobility problems that were presented quite effectively. Beliefs that this group will use transit are inconsistent with their increasing automobile ownership. This group also has the most leisure time and there were papers presented on leisure travel - defined much differently in Europe than in North America, where it generally includes only recreational travel.

Freight transport, which is all too often ignored in sustainable transport discussions, was given considerable attention here. Questions of how to measure sustainable transport was given some attention, but not resolved as there is a growing concern for inclusion of equity issues in this term.

Interactions between land use and mobility were discussed extensively and this is one of the areas where North America differs significantly from Europe. On the other hand both areas believe that educational programs that would influence individual mode choices would be useful. Research on children's attitudes toward automobiles was included in the papers presented.

Pricing strategies were discussed in terms of their acceptance as well as their utility. Congestion pricing, now called *A*value pricing,<sup>@</sup> does not seem to be any more practical in most locations with its new name. Marketable pollution permits for transport were also discussed. The adoption of cleaner technology was illustrated with the electric car, and the impacts of tele-technology cities and future electric commerce on travel discussed.

A morning plenary session on the final day of the conference saw representatives of European Commission, the U.S. Department of Transportation (U.S. DOT), the European Science Foundation, and the National Science Foundation discussing research opportunities. Keith Keen of the European Commission argued for research to support policy decisions and identified key elements of the 5<sup>th</sup> Framework Programme with particular emphasis on its provisions for *A*sustainable mobility and intermodality research.<sup>@</sup> Ashish Sen identified potential roles for the U.S. DOT and Bert van der Knapp did the same for the ESF. Jeff Fenstermacher of NSF concluded this session suggesting the way in which that organization could fund basic research in this area. The general tone was one of optimism and there is reason to assume that these agencies will work together at a higher level than they have in the past.

The afternoon of the final day of the conference saw the formulation of a series of research needs statements by the participating researchers. These have been compiled and edited and appear in the following chapter. These will be distributed to research centers and foundations with the hope and belief that these will be examined in the near future by scholars in Europe and North America.



## Chapter 4 Research Needs

The research needs identified by the various groups and individuals in attendance at the Berkeley conference appear on the following pages of this report. Before we get to these a few words are in order on the process used to develop these. From the first day of the conference it was noted that one of the things we wanted to see come out of the conference was a series of research needs. We imposed an outline on the researchers and academicians that they undoubtedly found to be too rigid, but they nevertheless cooperated with our request. Several groups were formed and individuals went off into little clusters to identify what they believed were the most important research questions that could be addressed by the conference. In other cases some individual scholars had already written up projects that they thought should be pursued.

For the most part the research needs that appear here are as close to what we received as possible. In some cases we have corrected minor spelling or grammar problems brought on by the pace of the meeting, but for the most part the content of the forms is what we received. The forms frequently lack information on *A*length of project<sup>@</sup> and *A*estimated project cost.<sup>@</sup> As one who has pondered for days over proposed project budgets, I have no problem understanding this. In some cases the costs are driven by whether you use graduate students or post-doctoral staff, and this also impacts the length of the project in that students must usually work no more than half time, while they spend the rest of the time doing their studies. In many cases you are uncertain who will be available when a project is funded.

When these numbers do appear on the sheets they should be regarded as rough estimates only. Most of us have no idea what students and staff are paid on the two continents, who will be available to work on a project, and so forth, prior to drafting a final proposal.

In those cases where individuals have placed their names or other information on the sheets we have left this there. We have not included any information that goes beyond the information originally provided. Those wishing to contact the proposers of these projects could probably reach them through their universities or organizations. A list of attendees with their institutional affiliation appears in Appendix B.

One final point should be noted. We have retained nearly all of the statements and reproduced them here. A couple of proposals were dropped because they overlapped other proposals here by 80% or more, or were so incomplete that it was impossible to identify the nature of the research problem.

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

U.S. and European measures of transportation activity: implications of present census practice.

***Statement of the problem to be examined:***

Censuses of population and housing in the U.S., Canada, and Europe normally include questions relating to household and individual demand for and availability of transportation options. Each country organizes census contents in ways that differ from other countries= practices. For comparative analysis and international cooperation in transportation research and for transportation planning to proceed effectively, there must be agreement on what is denoted and connoted by census data as they relate to transportation.

***Objectives:***

To portray, compare, analyze, interpret, and publicize in a unified fashion how national censuses formulate questions, aggregate data, and publish results with the aim of improving understanding of what is measured, why it is measured, what is implied by the choice of measurement, and what are the implications of differences for comparative U.S./European research and planning practice regarding social change and sustainable transportation.

***Research design or approach:***

(1) Identify all countries in Europe and North America that include transport-related questions in recent periodic censuses. (2) Retrieve from bureau personnel and records of each census bureau the history of the transport-related questions that have been asked and the stated rationales for asking them. (3) Analyze comparatively the differences and the similarities in practices. (4) Identify areas of complexity and confusion. (5) Identify areas of shared understanding and common practice.

***Expected results:***

A published report that assembles and analyzes for the benefit of researchers, policy analysts and planners the information needed to make effective use of international data sets, and to highlight ways that statistical practice could be improved for both comparative analysis as well as for local domestic use.

***Length of project:***

At least three years.

***Estimated project costs:***

\$250,000

***Proposed by:***

John S. Adams, Professor of Geography, Planning & Public Affairs, University of Minnesota, Minneapolis, MN 55455, U.S.A. [e-mail: [adams004@umn.edu](mailto:adams004@umn.edu)]

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Settlement structure, household structure and travel demand

### ***Statement of the problem to be examined:***

The dynamics of social change and of suburbanisation interact to change the patterns of travel demand, often in the direction of space and energy consuming life styles.

### ***Objectives:***

Develop suitable models to identify the size of these effects controlling for the background variables and spatial self-selection.

### ***Research and design or approach:***

Estimation of structural equation models (SEM) based on suitable American and European travel behavior/time budget data sets enriched with network data.

### ***Expected results:***

Identification of the size of the land use-based effects open to policy.

### ***Length of project:***

24 - 30 months.

### ***Estimated project costs:***

5-6 years Research Assistant level researcher and incidental costs.

### ***Proposed by:***

K. W. Axhausen, ETH, Zurich

T. Golob, UC, Irvine

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Coping with the true cost relations

***Statement of the problem to be examined:***

It is well known that the costs of travel and housing are massively distorted through subsidies, pricing rules and the tax code. The question of how people would adjust to undistorted cost relations has not been studied in detail.

***Objectives:***

Two main objectives: 1) Establish marginal cost structures for travel and housing services based on a review of the literature for both American and European examples; 2) Stated response surveys with American and European households exploring the adjustments to these structures.

***Research design or approach:***

Adaptation of existing computer-based survey tools (MOBIPLAN) to explore both location choices and activity scheduling of households (Acomputer - HATS®)

***Expected results:***

Insights into stability of current housing preferences under changed cost structures.

***Length of project:***

24 - 30 months.

***Estimated project costs:***

48 - 60 person months, survey costs, incidental costs.

***Proposed by:***

K. W. Axhausen, ETH, Zurich

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Bound tight: The role of service trips for children and parents

***Statement of the problem to be examined:***

Service trips seem to dominate the schedule of parents and children reducing their freedom of choice while protecting them from imagined and real dangers of the urban and suburban environments. What are then the processes by which children wrest free/parent relinquish their embrace? And are there land-use interactions?

***Objectives:***

Study the degree of freedom/size of the range children have in their environments as a function of age, type of environment and culture. (See Hillman, Whitelegg et. al.)

***Research design or approach:***

Matched surveys in selected European and American urban areas. The areas will be selected based on a suitable experimental design varying car ownership, location type, female labour force participation.

***Expected results:***

Insights into the strategies of households to cope with their children's mobility. Identification of policies to reduce dependency while monitoring mobility and safety.

***Length of project:***

24 months.

***Estimated project costs:***

48 person months, survey costs, incidental costs.

***Proposed by:***

K. W. Axhausen, ETH, Zurich



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Mobility and modernity - Unfolding a fundamental social nexus in Europe and USA

***Statement of the problem to be examined:***

Late modern societies are increasingly stratified by access to both social and spatial mobility. How is it possible for these societies to assure their very access and at the same time cope with the social and ecological risks that arise from an ever increasing mobility.

***Objectives:***

To provide a better understanding of the role and function of mobility for modernization processes, i.e., to unfold the mobility modernity nexus.

***Research design or approach:***

Theoretical B make use of the findings of reflexive modernization theory in relation to transport and mobility.

Methodological B focus on how central agencies in Europe and the US assure social and spatial mobility and how they respond to the risks that evolve from mobility.

***Expected results:***

To propose policy recommendations of how to overcome the ostensible contradiction in towns, i.e. to promote sustainable mobility in Europe and the US.

***Length of project:***

3 - 4 years, interdisciplinary group of researchers (social scientists, geographers, planners, engineers Y)

***Estimated project costs:***

~ 100 person months and overheadY

***Proposed by:***

Joerg Bechmann,      University of Copenhagen, DkLinnesjade 22, 1361 Copenhagen  
Tel: 0045-35 32 32 9      Joerg.beckmann@sociology.ku.dk

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Intermodality as a solution for sustainable freight transport

***Statement of the problem to be examined:***

Intermodality is advocated but its potential is uncertain. How to organize it?

***Objectives:***

Analyze different techniques and organizations of dedicated networks for intermodality.

***Research design or approach:***

GIS network analysis which should be developed to enable the treatment of all kinds of dedicated networks (e.g., SPOUE) as well as their modal operations.

***Expected results:***

Assessment of specific intermodal solutions.

***Length of project:***

2 years.

***Estimated project costs:***

\$100,000 on the Belgian side (1 researcher x 2 years)

***Proposed by:***

M. Beuthe and B. Jourquin

## Conference on Social Change and Sustainable Transport Research Needs Statement

***Descriptive title of project:***

Evaluation of quality attributes of freight transport modes

***Statement of the problem to be examined:***

Reliability, information, safety, speed are taken into account for modal choice but are not well understood.

***Objectives:***

Monetary assessment in order to reach a complete definition of  $\Delta$ generalized cost $\Delta$ .

***Research design or approach:***

$\Delta$ Stated preference $\Delta$  approach with interviews of shippers.

***Expected results:***

Relative quality assessment  
Better planning tools (for intermodality for instance)

***Length of project:***

2-3 years.

***Estimated project costs:***

\$200,000 on the Belgian side, plus \$???

 the USA partner

***Proposed by:***

M. Beuthe and B. Jourquin

## Conference on Social Change and Sustainable Transport Research Needs Statement

***Descriptive title of project:***

Analysis of congestion costs of freight transport through network models.

***Statement of the problem to be examined:***

Congested flows slow speed and spread traffic over networks. It is costly. It raises questions regarding how to plan future networks.

***Objectives:***

Develop a large multimodal network model providing an equilibrium solution to freight traffic flows.

***Research design or approach:***

Cost functions on a link must be function of flow volumes. These should be integrated within the model. An equilibrium solution should be found through an iterative process. The basic model would be ANODUS<sup>23</sup> based which allows an analysis of terminal operations and their capacity.

***Expected results:***

A model handling multimodal and multimeans networks and providing equilibrium solutions taking into account congestion.

***Length of project:***

2 years (?)

***Estimated project costs:***

\$100,000 (Belgian site) (1 researcher)

Partner in USA: \$? (2 good researchers over 2 years)

***Proposed by:***

M. Beuthe and B. Jourquin

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<sup>23</sup> NODUS is a geographic information system capable of handling transport applications.

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Development and evaluation of an index of sustainable transport

***Statement of the problem to be examined:***

An index of sustainable transport is proposed that incorporates global and local pollution, accidents, congestion, and the finite nature of petroleum resources, as well as measures of alternative fuel vehicles, transit offerings, gasohol, and related factors.

***Objectives:***

To construct an index that would allow policy makers to have some measure of where different areas stand on sustainable transport and enable them to evaluate progress toward sustainable transport as a function of different policies and plans prior to implementation.

***Research design or approach:***

It is expected that the index would be constructed using data that are readily available from published sources such as the *Highway Statistics* volumes of the Federal Highway Administration, or annual reports of the Federal Transit Administration. Where estimates are used these methods will be identified. The data would be subjected to a principal components analysis and the first general factor (unrotated) would be evaluated to determine if it reflected the continuum from sustainability to non-sustainability. Assuming that it did the first factor could be used to construct the index using traditional methods. The index developed could be applied to areas of the United States and selected countries or provinces in Europe to determine its broad applicability.

***Expected results:***

It is believed that such an index could be constructed and that it would be sensitive enough for evaluating policies of sustainability. Different areas may need to have indices calibrated for local conditions.

***Length of project:***

Eighteen months.

***Estimated project costs:***

\$100,000

***Proposed by:***

W. R. Black, Indiana University

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

The growth of daily tourism in coastal areas: Impact on transport and the environment.

***Statement of the problem to be examined:***

A study of daily tourism is proposed since this activity produces very unsustainable mobility, high use of the car, spatial concentration, intense use of the resources (natural, etc.)

***Objectives:***

To identify areas which are more or less subjected to daily tourism using accessibility measures. An evaluation of potential daily tourist populations will be undertaken using the existing distribution of population and other opportunities.

***Research design or approach:***

The research can be carried out using some available data (road network, administrative boundaries) and some socio-economic data which need to be collected through effectual statistical institutions of different countries.

The accessibility index (measured through travel time) needs to be refined as well as the method for evaluation of potential daily tourism.

***Expected results:***

Such study should lead to policy suggestions for traffic management in tourist areas particularly through a leisure policy (management and marketing of the resource, etc.) strong is the EU-US comparative potential.

***Length of project:***

Eighteen month

***Estimated project costs:***

\$30,000

***Proposed by:***

Cristina Capineri, University of Siena (Italy)

Gianfranco Spinelli, University of Piemonte Orientali (Italy)

# **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Environmental equity aspects in airport planning

***Statement of the problem to be examined:***

Are there inequities in airport noise exposure? How were the distribution dynamics played out? What are the second-order equity implications of airports?

***Objectives:***

Examine environmental equity aspects and related methodological issues of airports, as a first step toward the introduction of environmental equity facets into the sustainable transport discourse.

***Research design or approach:***

Four stages:

1. Examine distribution aspects of airport noise on basis of FAR 150 planes (in US) and similar planes in Europe.
2. Examine land use changes, metropolitan dynamics, and decision processes since the airport was originally conceived.
3. Identify airport users= attributes and compare to effected population. Concurrently, identify the airport=s regional effects as a base for analyses of their distribution effects.
4. Compare out comes as a function of institutional structures across airports.

***Expected results:***

Two main results:

- (a0 Addressing methodological issues inherent in all environmental equity analyses of transportation.
- (b0 Identification of common and differentiating factors determining environmental (in)equities of airports, as a demonstration for other transport systems.

***Length of project:***

2 years

***Estimated project costs:***

\$50-80,000 per case (airport analyzed)

***Proposed by:***

Eran Feitelson

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Can decentralized production be a sustainable new production concept?

### ***Statement of the problem to be examined:***

Economies of scale are one of the driving forces in transport but there are some signs that economies of scope are becoming more important for some companies.

### ***Objectives:***

Global players and their suppliers with the focus to their logistic strategies and their location choices (Production and logistics facilities).

### ***Research design or approach:***

Case studies

### ***Expected results:***

Answer of the question: Can this production concept be a sustainable one.

### ***Length of project:***

1.5 years

### ***Estimated project costs:***

150,000 ECU

### ***Proposed by:***

Heike Flämig  
IOW  
Potsdamer Ste. 105  
10785 Berlin  
Germany



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

The role of actors in policy formulation and evaluation

### ***Statement of the problem to be examined:***

Policy development in cooperation with actors in mobility system

### ***Objectives:***

International/transatlantic comparison of the contribution of actor-oriented approval to policy development and towards sustainable mobility; strategic planning.

### ***Research design or approach:***

- \_ Group modelling
- \_ Policy tests
- \_ Policy assessment
- \_ Strategic planning

### ***Expected results:***

Strategic policy-making taking the actor role (constraints and possibilities) into account.

### ***Length of project:***

3 years

### ***Estimated project costs:***

\$400,000 - \$500,000

### ***Proposed by:***

Corine Mauch  
Geog. Institut ETH  
Winterthurerstr. 190  
8057 Zürich  
Switzerland

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Exploring measures to deal with urban sprawl through interactive meetings of planners and transport providers

***Statement of the problem to be examined:***

How are planners dealing with urban sprawl in European and American contexts? What can be learnt from each other's experience.

***Objectives:***

To get together city planners from key cities to examine what can be learnt from local on the ground experience. This could lead to new ways and approaches of dealing with sprawl.

***Research design or approach:***

Organize three or four meetings of planners and transport providers in neutral venues to discuss sprawl. The data requirements would be set by researchers conducting the study. These would also be responsible for monitoring of the meeting and analysis of the results.

***Expected results:***

The issues that local planners have explored could be presented widely to aid some lateral thinking.

***Length of project:***

About one (1) year.

***Estimated project costs:***

Unclear as yet.

***Proposed by:***

Caralampo Focas  
UK

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Sustainability issues in just-in-time systems.

***Statement of the problem to be examined:***

Do just-in-time systems reduce overall net social costs? Analyses of the question within and between Europe and North America will provide better comparative perspectives on this issue due to the different valuations of energy, time and social priorities.

***Objectives:***

To assess the sustainability attributes of just-in-time delivery systems.

***Research design or approach:***

Set of case studies across locations (urban/rural) and industries and across supply claims within and between countries and between continents (EU & NAFTA)

- a) Common Industry Groups e.g. Fabricated Metals, Plastics, etc.
- b) Supply claims of each
- c) Across 1) countries; 2) continents (EU/NAFTA)

***Expected results:***

A better understanding of this attribute of manufacturing firms and others at the beginning of the century.

***Length of project:***

2 2 years (10 person)

***Estimated project costs:***

\$2.5 million or 2 million ECU

***Proposed by:***

Haynes  
Flämig  
Y. B. Yim  
Jourquin  
Janelle

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Transportation and telecommunication: sustainability tradeoffs in the service economy.

***Statement of the problem to be examined:***

What are the tradeoffs between transportation and telecommunication in terms of substitution, complementarity, and synergy but with the rapidly growing service sector.

***Objectives:***

Create economic portfolio for criteria that envelopes the trade-offs.

***Research design or approach:***

Develop an econometric model to be estimated and tested in the North American and Europe and in particular the potential and existing role of electronic commerce.

***Expected results:***

See if industrial service sectors produce significantly different trade-offs between transportation and telecommunication in terms of sustainability indices.

***Length of project:***

2 years (4 people)

***Estimated project costs:***

\$600,000 or 500,000 ECU

***Proposed by:***

Haynes  
Janelle  
Jourquin  
Yim  
Flämig

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Transportation, sustainable investments and environmental justice.

***Statement of the problem to be examined:***

What is the scale and methodology to be used in evaluating transportation investments that minimize environmental impacts directly, but does not distort the accessibility matrix of existing systems let alone reduce previous patterns.

***Objectives:***

Develop a template with methodology for environmental justice and transportation investment.

***Research design or approach:***

Utilize existing spatial autocorrelation methodology to develop this methodology and make it operational for state and local transport planners.

***Expected results:***

A set of guidelines for local planners embedding environmental justice into transport sustainability planning.

***Length of project:***

2 years

***Estimated project costs:***

\$250,000 or 200,000 ECU

***Proposed by:***

Haynes  
Janelle  
Jorquin  
Flämig  
Yim

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

The impact of transportation and trade on market integration in the EU and NAFTA on employment and productivity.

### ***Statement of the problem to be examined:***

Does market integration increase employment difference within mega-regions and across regions as productivity advantages are exploited by transportation advantages.

### ***Objectives:***

To better understand the role of market integration.

### ***Research design or approach:***

Use TFP to assess manufacturing employment change with respect to trade and productivity in the US (US States) EU (County/Regions) and exchange between these systems. Productivity analysis and shift-share analysis.

### ***Expected results:***

I solution of the link between economic change and transport change especially as it relates to market integration and productivity.

### ***Length of project:***

2 years (5 people)

### ***Estimated project costs:***

\$250,000 200,000 ECU

### ***Proposed by:***

Haynes  
Janelle  
Jourquin  
Fleming  
Yim

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Integrating social theory and the political-economy of metropolitan transportation planning in North America and Europe.

### ***Statement of the problem to be examined:***

Problem: Understanding barriers to change.

By utilizing critical social theory and a political economy framework of analysis, an exploration of the barriers to implementing social change for remote sustainable transportation policies can be gained.

### ***Objectives:***

To examine differences and similarities among advanced capitalistic nations. It is emphasized that in transport planning, differences are stressed, while similarities are ignored.

### ***Research design or approach:***

Qualitative methods: Interviews with key players in metropolitan planning, including government officials, business leaders, special interest groups such as homeowners and environmentalists.

Quantitative methods: Analysis of demographic trends and real estate trends as they relate to transport infrastructure investment.

### ***Expected results:***

A clearer, more holistic understanding of the planning process in advanced capitalistic economies. It is expected that since Europe and the USA have different structures of capitalism, there will be different policies, but also similarities. These similarities may be more significant than is currently understood.

### ***Length of project:***

3-4 years.

### ***Estimated project costs:***

\$100,000: Travel between North America and Europe; accommodations; computer; telecommunications.

### ***Proposed by:***

Jason Henderson, jhenderson@arches.uga.edu, University of Georgia, Athens, Department of Geography

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Social theory, modernization and mobility

***Statement of the problem to be examined:***

There is a lack of understanding of social change related to transport and mobility, and a general lack of sensitivity of the role of current social theory regarding mobility issues.

***Objectives:***

Introducing mobility and transport notions into social theory (e.g.: modernization theory, critical social theory, postmodernism)

***Research design or approach:***

Undecided

***Expected results:***

Better understanding of mobility and transport developments with regard to socio-spatial changes.

***Length of project:***

1-2 years, workshop/working group oriented.

***Estimated project costs:***

[depends on size of group, meeting frequencies, etc.]

***Proposed by:***

Dr. Markus Hesse, IRS - Institute, Erkner, Germany



# Conference on Social Change and Sustainable Transport

## Research Needs Statement

### *Descriptive title of project:*

Transport speed and social change.

### *Statement of the problem to be examined:*

There are numerous stakeholders with defined interests in either higher or lower speed limits. Since speed limits define the nature of transport accessibility advantages of places in regions, this has implications for the regional space economy and to the sustainability of transportation.

### *Objectives:*

- \_ Document historical trends in speed limits/behavior/enforcement.
- \_ Document the implications of speed for regional variations in speed limits in Europe and North America.
- \_ Explicate the logic of the arguments by stake holders (e.g., manufacturers, insurance industry, law enforcement, etc.)
- \_ Bring researchers on speed together for intensive workshop.

### *Research design or approach:*

Inventory: cross national surveys of literature on speed (regulations [limits], behavior, speed by drivers, speed enforcement). Analysis: Exploratory data analysis and historical background; Comparative documentation of the situation and pattern of changes in North America and Europe; Full-costing of speed on society. Evaluation: Interpretation with regard to cultural and political factors at play in Europe and North America and the implications for regional benefits.

### *Expected results:*

- \_ Research publications focused on the theory of speed in society, comparative analyses on Europe and North America.
- \_ A research conference dealing with comparative cross-national analysis of speed limits.

### *Length of project:*

3 years. 1) conceptualization and identify of data sources; 2) analysis; 3) Preparation of research reports and publications, research workshop.

### *Estimated project costs:*

\$125,000 -- \$70,000 for access to research resources, analyses, travel and final preparation of reports; \$55,000 to sponsor a small-group research workshop (25 to 30 researchers of international origins)

### *Proposed by:*

Don Janelle and Piet Rietveld

## Conference on Social Change and Sustainable Transport Research Needs Statement

***Descriptive title of project:***

Door to door through the Atlantic Ocean: a freight model

***Statement of the problem to be examined:***

Which are the transportation chains that are utilized for freight flows from producers to a customers located on two separated continents?

***Objectives:***

Building up a multimodal - intermodal network of both America and Europe and the trans Atlantic lines. Coming up with consistent cost functions for the different modes and means of transportation.

***Research design or approach:***

Multi-modal network model (possibly NODUS), minimisation of generalized cost function. Collecting information on coherent O-D matrixes for commodities.

***Expected results:***

Constructing a validated reference scenario. Use it as a tool to study a set of policy and regulatory scenarios, among others.

***Length of project:***

2 years.

***Estimated project costs:***

\$100,000 in Europe (1 researcher)  
\$???,??? in America (2 researchers)

***Proposed by:***

Bart Jourquin and Michel Beuthe

Remark: some work has been completed in Europe so that more research may be needed in the USA! That's why two researchers are proposed there.

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Comparative impacts of external costs of freight transport in Europe and North America.

***Statement of the problem to be examined:***

What is the impact of the internalization of external cost on mode and route choice for freight transport?

***Objectives:***

Building up coherent cost functions for the different transportation modes in Europe and the USA. Coherent evaluation of the external costs on both sides of the Atlantic.

***Research design or approach:***

Multi-modal freight network model.

***Expected results:***

Building validation reference scenarios for both sides of the Atlantic. Introduce externalities and analyze the impact on the reference scenario. Compare the impacts in North American and Europe.

***Length of project:***

2 years

***Estimated project costs:***

\$100,000 in Europe (1 researcher)  
same in North America

***Proposed by:***

Bart Jourquin and Michel Beuthe

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

A study of EU-USA integrated policies to face the consequences of social change on the sustainability of transport.

***Statement of the problem to be examined:***

We seek to compare the impact of existing stand alone EU and USA transport pricing and supply policies on the environmental sustainability of their respective transport systems, within a general equilibrium modelling framework, and we then use this general equilibrium framework to see how we can improve upon these results by integrated policies in the EU and the USA.

***Objectives:***

***Research design or approach:***

It is important to see transport demand as a derived demand, i.e., demand derived from the economic activities in an economy. Transport policies therefore cannot be studied outside the context in which it is present. We therefore develop a general equilibrium model that incorporates this idea. It is also important to notice the network character of transport. We therefore incorporate this characteristic into the model by combining the general equilibrium model with transportation network equilibrium models well-known in operations research.

This model is used as a framework to assess the impact of existing transport pricing and supply policies in the EU and the USA, and study what EU-USA integrated policies can improve upon these stand-alone policies.

***Expected results:***

A general equilibrium framework based on the idea of transport demand as a derived demand and that combines with transportation network equilibrium models to incorporate the network character of transport. Since the model is based on the behavior of its agents, it models the technology of transport, and assesses policies pointed towards those issues. A comparison of existing transport (pricing and supply) policies on the EU and USA, and suggestions on how to improve upon these stand-alone policies by an integrative approach within this framework.

***Length of project:***

Two years.

***Estimated project costs:***

\$100,000

***Proposed by:***

Hans Kremers, Free University Amsterdam, The Netherlands

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

The optimal amount of mobility

***Statement of the problem to be examined:***

Determine the full cost and benefits of transport.

***Objectives:***

In order to determine the optimal amount of mobility to attain in an ecologically and economically sustainable transport system.

***Research design or approach:***

Measure in an economic framework the private and social costs and benefits of transport. This will establish cost and benefit functions which show how extremes of positive and negative externalities interrelate.

***Expected results:***

A series of economically valid cost and benefit function, which relate the optimal amount of transport to technology and flow levels.

***Length of project:***

2 years

***Estimated project costs:***

\$150,000

***Proposed by:***

David Levinson

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Behavioral effects, public acceptability and efficiency of road pricing for sustainable transport.

***Statement of the problem to be examined:***

Pricing instruments become an increasingly realistic option in transport policies seeking a more sustainable transport system. Information on the behavioural impacts, public/political acceptability and efficiency of realistic pricing schemes, however, is still incomplete, scarce, and scattered. This project aims to improve our knowledge on these topics, focusing on and exploring the advantages of comparative transatlantic research.

***Objectives:***

Improve our knowledge of behavioral effects, public and political acceptability, efficiency of pricing instruments (including interactions), while taking into account constraints imposed by implementability.

***Research design or approach:***

Several paths: information exchange (e.g., internet-based facilities); comparative review studies of available evidence; jointly undertaken questionnaire studies utilizing the variances in institutional cultural and political structures; workshops; comparative case studies, and modeling efforts incorporating comparative data sets.

***Expected results:***

Tangible results: vehicles for information exchange (workshop/internet); joint articles/books/other publications; working models tested in North America and European data sets, that can be used to explore implementation issues arising in actual project proposals.

***Length of project:***

***Estimated project costs:***

***Proposed by:***

David Levinson, Ken Small, David Boyce, Margaret O'Mahony, Eran Feitelson, Hans Kremers, Eric Verhoef

# Conference on Social Change and Sustainable Transport Research Needs Statement

***Descriptive title of project:***

Land-use, transport and the environment in Chicago and Stockholm: empirical and theoretical analysis.

***Statement of the problem to be examined:***

Similarities and differences between land-use and transportation problems and development. Compare with criteria of sustainability. Are Chicago and Stockholm developments compatible with sustainability?

***Objectives:***

Comparative analysis of land-use/transport/environmental patterns and development of Chicago and Stockholm (as reasonably representative of North America and European context).

***Research design or approach:***

Empirical and theoretical analysis of: background facts on driving forces; land-use/transport patterns and developments; emissions, air quality, environmental sustainability; policy alternatives. Use one and the same integrated land-use/transport model (Kim, 1989) possibly with some adaptations to individual cities

***Expected results:***

Comparative empirical analysis	}	Driving forces -
Comparative model analysis	}	Density - Location - Mobility -
		-Emissions
		Policy analysis and package policies

***Length of project:***

12 months

***Estimated project costs:***

\$100,000

***Proposed by:***

Lars Lundquist  
T. John Kim

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Monitoring the active city.

***Statement of the problem to be examined:***

Most of sociological data on cities come from census type observations (night time population, i.e., one time shots). Increasingly cities rely on daytime populations and are affected by them. No systematic monitoring of this aspect is available.

***Objectives:***

To conduct a feasibility study (in view of more generalized surveys) of a small sample of volunteers will record daily movements, monitor their geographical location with GPS tools and probing them with cell phones to survey what they are doing, with whom, and why.

***Research design or approach:***

The research design inputs first a selection of the best combination of technological tools, then the definition of data to be collected starting from dialog type quantitative reports to increasingly coded and structured responses; the setting up of the monitoring system and the modeling of flows of movements. A sample of 50 to 100 persons for a one to two weeks period is envisaged at this stage.

***Expected results:***

- A) Assessment of optimal technology to produce image scale geocoded data on mobility behaviors.
- B) Advances in systematic classification of daily life activities and time use.
- C) Advances in sociological understanding of mobility.

***Length of project:***

In the first phase proposed here: 6 to 12 months.

***Estimated project costs:***

\$50,000 to \$100,000

***Proposed by:***

Guido Martinotti, Chair of Urban Sociology, Universite degli studi di Milano Bicocca



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Understanding the intrinsic desire to travel

***Statement of the problem to be examined:***

If there is a desire to travel for its own sake, then policies intended to reduce travel may not have the expected effect, and in fact may be vigorously opposed. It is important to understand the extent to which such a desire exists, and the types of circumstances and people for which it exists.

***Objectives:***

To measure the desire to travel, and relationships between that desire and attitudes toward travel and land use, personality traits, lifestyle drives, objective mobility, perceived mobility, sociodemographic characteristics, and responses to congestion.

***Research design or approach:***

A survey measuring the above variables has already been constructed in English and administered in the San Francisco area. It would be extremely valuable to administer a similar survey in other cultures; possibly representative countries from the ARoman,@ AGermanic,@ AScandinavian,@ and other clusters. The data thus collected will be analyzed for similarities and differences across cultures.

***Expected results:***

This project will provide additional insight into the basis for human travel behavior. This insight should point to fruitful ways of affecting that behavior, as well as identifying strategies that may not be fruitful and hence should be reconsidered. The result should be policies that are more effective and consistent with natural human desires rather than counter to them.

***Length of project:***

2 years

***Estimated project costs:***

\$200,000

***Proposed by:***

Patricia Mokhtarian and Ilan Salomon

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Information and communication technology and the city

***Statement of the problem to be examined:***

The impact of public policy on city evolution through an analysis of both the attitudes/behaviour of citizens and firms.

***Objectives:***

To trace the long-range impacts of ICT network technologies.

***Research design or approach:***

Literature search, hypothesis formulation, data collection, modelling and testing.

***Expected results:***

A strategic perspective on the role of public policy.

***Length of project:***

2 years.

***Estimated project costs:***

Not determined.

***Proposed by:***

P. Nijkamp

***Participants:***

P. Nijkamp  
G. Cohen  
I. Salomon  
T. R. Lakshmanan  
P. Mokhtarian

## Conference on Social Change and Sustainable Transport Research Needs Statement

***Descriptive title of project:***

Road safety and speed

***Statement of the problem to be examined:***

The impact of speed (urban, interurban) and speed regulations on fatality rates.

***Objectives:***

To improve our fragmented understanding of the relationship between speed and safety.

***Research design or approach:***

Collection of data on a joint design basis. Comparative study on common background factors. Comparative analysis of policy impacts.

***Expected Results:***

Recommendations for road safety policy.

***Length of project:***

2 years.

***Estimated project costs:***

Not determined

***Proposed by:***

P. Nijkamp, P. Rietveld, D. Shefer

***Participants:***

Th. Golob

D. Shefer

M. Wachs

P. Rietveld

P. Nijkamp

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Children and sustainable transportation.

### ***Statement of the problem to be examined:***

The impact of cars on children has not received broad academic or public attention. These extensive impacts deserve wider recognition for the benefit of children and also because of their implications for social, environmental and cultural sustainability. Also, studies indicate that children can be an effective focus for sustainable transportation strategies: 1) as change agents through changing their behaviour and their parents' behaviour (particularly regarding school trips); 2) as an incentive for transportation behaviour change through appealing to the emotional attachment of parents for their children.

### ***Objectives:***

To carry out a series of pilot studies which contribute to our knowledge about children as potential change agents and a focal point for sustainable transportation strategies.

### ***Research design or approach:***

Pilot studies would be carried out in Britain, Canada and the United States. The pilot studies would have three components: 1) Introducing small groups of parents to information about children and cars, e.g. school councils. Providing parent groups with training to understand and analyze opportunities to reduce car usage. Parents from each group would be trained to teach parents from other parent groups; 2) Educational materials would be developed and introduced for children at several age levels (ages 7, 10 and 12) to determine their response and explore whether certain age groups are more effective change agents; 3) a pilot training video would be created which assists parents to understand the issues around children and sustainable transportation.

### ***Expected results:***

Evidence to indicate effective strategies for fostering sustainable transportation behaviour with parents and children.

### ***Length of project:***

2 years.

### ***Estimated project costs:***

\$200,000

### ***Proposed by:***

Catherine O'Brien, York University  
Birgitta Gatersleben, University of Surrey

## Conference on Social Change and Sustainable Transport Research Needs Statement

### *Descriptive title of project:*

The mobility/sustainability implications of modern urban landscapes.

### *Statement of the problem to be examined:*

The project will examine sprawling suburbs, edge cities and their implications for transportation, [i.e. examine the Ajobs@balance]. Implicit in the spatial arrangement of residential/employment location are patterns of flow; what are the major features of these patterns?

### *Objectives:*

Organize comparative consistent data bases; develop benchmarking techniques. Recognize Aderived demand@ characterization. Explore practical issues of decentralized concentration, the new urbanism and policies aimed at encouraging mixed use development (with transit?)

### *Research design or approach:*

Characterize the spatial arrangement [e.g. Atlanta; work out some upper and lower bounds on the outcome of movement needed to link places of work and places of residence (O-D matrix). Solve for extreme values of key measures using generalized land-use transport models. Examine impact of various modal split scenarios. Investigate role of metro wide solutions [e.g. Minneapolis].

### *Expected results:*

Raise awareness on the part of U.S. city planners of the trends/costs/and livability/sustainability of emerging urban growth patterns.

### *Length of project:*

2 years.

### *Estimated project costs:*

Not estimated

### *Proposed by:*

Morton O-Kelly  
Lundqvist/Kim

Relates to presentations by Markus Hesse, and Nigel Spence, Elizabeth Deakin, Jason Henderson, John Adams

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Assessment of organizational restructuring for a sustainable transportation paradigm

### ***Statement of the problem to be examined:***

The mission, means, and culture of organizations in both public and private sector would have to change significantly in order to implement sustainable transportation.

### ***Objectives:***

This project would identify the organizational and institutional dimensions of that transformation.

### ***Research design or approach:***

Construct a theoretical model of organizational change that applies to the transport sector, which is drawn from Areinvention@ literature. Identify episodes and examples of such restructuring that have already begun in relation to sustainable transportation. Evaluate triggers and thresholds for such organizational change. Consider institutional changes required to facilitate and entrench the practice of sustainable transportation.

### ***Expected results:***

Models of organizational and institutional change would be developed, along with scenarios of how they might unfold.

### ***Length of project:***

24 months.

### ***Estimated project costs:***

\$60,000

### ***Proposed by:***

Anthony Perl, University of Calgary

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Employer's role in passenger transport (company cars, company parking)

***Statement of the problem to be examined:***

Policies of employers (location choice, institutional arrangements of travel costs) have considerable impacts on travel behaviors of employees. These consequences are not yet fully understood.

***Objectives:***

Understanding 1) interplay between public sector, passengers and employers; and 2) their implications for passenger transport.

***Research design or approach:***

- \_ Survey of fiscal rules concerning company cars/parking
- \_ Survey of firm policies concerning company cars/parking
- \_ Survey of actual use by employees
- \_ Analysis of behaviors of actions (agency theory)
- \_ Analysis of (unintended) effects on travel behaviour.
- \_ Analysis of use of information technology to improve practices.

***Expected results:***

- \_ Overview of importance of company cars/parking on travel behaviour
- \_ Insights into arrangements that reduce unintended effects of present practices.

***Length of project:***

1-2 years

***Estimated project costs:***

\$100 - \$200 depending on number of countries involved.

***Proposed by:***

Piet Rietveld

Interest expressed by: Ilan Salomon, Israel, US, Jos van Drummeren, UK Roger Stough; US, and Jean Pierre Orfenil; France

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Women, travel, and environment

***Statement of the problem to be examined:***

Location of major levers that influence gendered travel behaviors.

***Objectives:***

Identification of social, psychological and economic factors that contribute to more sustainable transport.

***Research design or approach:***

Identification and use of comparative European and US statistics on women's travel, environmental impacts and correlations with social change/trends, (e.g. employment levels, demographics, etc.). Using US and European partners.

***Expected results:***

More appropriate policy interventions.

***Length of project:***

2 years

***Estimated project costs:***

Not estimated.

***Proposed by:***

Amanda Root (Transport Studies Unit, University of Oxford) and  
Laurie Schintler (George Mason University)



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Global warming, international agreements and transport policies

### ***Statement of the problem to be examined:***

Considers the implications of international agreements on greenhouse gas abatement for transport policies, both national and international.

### ***Objectives:***

Prepare alternative implementation schemes in terms of economic efficiency and political feasibility.

### ***Research design or approach:***

Possibly with the use of computer simulation models (e.g. extended integrated assessment models<sup>®</sup>) taking into account the implementation of tradable emissions permits.

### ***Expected results:***

Provide policy guidelines and forecasts.

### ***Length of project:***

To be determined.

### ***Estimated project costs:***

To be determined.

### ***Proposed by:***

Roberto Roson  
Universita Ca Foscari di Venezia  
Italy

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Transportation and land development on the periphery: comparative studies of U.S. and European cities

***Statement of the problem to be examined:***

- 1) Is growth in the periphery of European cities more or less sustainable than growth in the periphery of U.S. cities?
- 2) What transportation and land use planning factors are influencing different patterns of growth?

***Objectives:***

- 1) How do planners and developers interact in the land development process?
- 2) At what points in the planning process might sustainability goals be interjected in the planning process?

***Research design or approach:***

- 1) Content analysis of a set of European and U.S. cities= land use and transportation plans.
- 2) Interviews with European and U.S. land use planners and transportation planners.
- 3) Interviews with European and U.S. developers.

***Expected results:***

Increased understanding of sustainability goals that are most feasible from a political perspective and from the perspective of private developers.

***Length of project:***

1.5 years

***Estimated project costs:***

\$50,000

***Proposed by:***

Dr. Sherry Ryan  
Dr. James C. Throgmorton

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Viability of Avalue pricing<sup>®</sup> for traffic management.

***Statement of the problem to be examined:***

Determine the range of situations in which offering an optimal premium service (congestion-free travel for a toll) has positive social benefits.

***Objectives:***

Guide the design of an important policy initiative that is often viewed as a step toward full road pricing.

***Research design or approach:***

Develop models with two similar (not necessarily identical) roads or road networks, one free and one priced. Users are to be heterogeneous in the value they place on reducing congestion. Simulate models using parameters drawn from actual value-pricing experiments in the US.

***Expected results:***

When heterogeneity is sufficient, the product differentiation advantage dominates, making value pricing beneficial compared to no tolls anywhere.

***Length of project:***

1 year

***Estimated project costs:***

\$65,000

***Proposed by:***

Kenneth Small

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Social aspects on small clean urban vehicles (UV)

### ***Statement of the problem to be examined:***

The all purpose car is not consistent with sustainable development in urban areas. A small clean urban vehicle may be an attractive alternative? From an environmentally point of view , it is, but is it perceived to be attractive from a social science perspective?

### ***Objectives:***

### ***Research design or approach:***

For which kinds of travel purposes can UVs replace cars in use today? What level of capacity is needed for the UV?

### ***Expected results:***

A wide multidisciplinary assessment of the potential of small clean urban vehicles, in relation to the all purpose car and other transport modes.

### ***Length of project:***

### ***Estimated project costs:***

### ***Proposed by:***

Peter Steen

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Sustainability indicators

***Statement of the problem to be examined:***

Development of new indicators that account for under-represented groups and issues e.g. leisure, women, elderly, children.

***Objectives:***

Raise profile and visibility of these issues.

***Research design or approach:***

Collection of data, survey existing indicators (Europe & USA), use of focus groups to identify new indicators and align to existing data sources.

***Expected results:***

New data sets and collection of new data.

***Length of project:***

2 years

***Estimated project costs:***

\$100,000 - \$250,000

***Proposed by:***

Sub Group 1

Small, Feitelson, Gudmundsson, Visser, Spence, Gilbert, Beuthe, Levinson, Verhoef, Maat, O'Brien, Root, Schintler, O-Kelly, Frandberg, Spinelli, Kremers, Moriguchi, Capineri, O-Mahoney, Tillberg, Johnston, Spiekermann, Lundqvist, Jantunen, Root, Priemus, Boyce

## **Research Needs Statement**

### ***Descriptive title of project:***

Public participation and transportation decision making

### ***Statement of the problem to be examined:***

Despite the great demands by the public and the legal requirements, the process of public involvement seldom yields desirable results. The US DOT and other agencies have published numerous manuals, guidebooks and case studies, but this literature suffers from several weaknesses, especially its non-theoretical non-comparative and parochial character.

### ***Objectives:***

To relate the mechanisms of public participation to specific issues on the basis of explicit evaluative criteria.

### ***Research design or approach:***

A group of scholars would: (1) identify and classify the public involvement mechanisms that are available in the US and Europe. (2) Develop evaluative criteria to assess these practices. (3) Develop a typology of transportation policies and of projects. (4) Identify the ways in which the public presently participates in transportation decisions and evaluate these practices. (5) Analyze the existing materials and carry out field research to ascertain the relationships between policy and project types and the most appropriate mechanisms.

### ***Expected results:***

Enhanced understanding of the ways in which the public can participate most meaningfully and effectively in transportation decision making thus strengthening this process and promoting democracy and sustainability

### ***Length of project:***

18 months

### ***Estimated project costs:***

Not determined

### ***Proposed by:***

Joseph Szyliowicz

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Comparative transportation policies: the ethical dimension

***Statement of the problem to be examined:***

The issue of how to resolve the inequities created by transportation is one that confronts all democratic societies. This project proposes to carry out a comparative analysis of how various countries deal with this problem.

***Objectives:***

To understand how different nation states define and delineate equity. Such questions as: (1) how do transportation policies relate to equity issues in terms of goals and objectives? (2) What policy instruments are utilized? (3) How are they implemented? (4) With what results?

***Research design or approach:***

The study would include a group of scholars who would meet to discuss and refine a previously prepared conceptual framework that (1) specified various forms of democratic policy processes, (2) the dimensions of equity, and (3) policy instruments. Then the team members would carry out field research using such techniques as content analysis, interviews, and so forth. The findings would be presented and discussed.

***Expected results:***

The study would result in a book that would contribute to our understanding of comparative transportation policies and would specifically provide important insights into a neglected area of transportation studies.

***Length of project:***

24 months

***Estimated project costs:***

Not estimated

***Proposed by:***

Joseph Szyliowicz

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

A guide to adoption of sustainable transport technology: The development of a coherent methodology to explore failure and success of adoption of sustainable transport technology, and the design of appropriate adoption policies.

### ***Statement of the problem to be examined:***

The design of a methodology is proposed that incorporates results of a causal model of technology adoption in transport, including various types of uncertainty, (national) institutional influences, and characteristics of the technology at hand. In addition, the design of improved adoption policies is proposed.

### ***Objectives:***

To construct a methodology that enables policy makers to anticipate success or failure of adoption, and to intervene in technology development and adjust adoption policies.

### ***Research design or approach:***

1. To design a tentative causal model of transport technology adoption.
2. To compare national (state) policies in Europe and North America concerning the adoption of electric vehicles, and to identify structural differences. To identify differences in the level of actual adoption. To improve the model by using the case of electric vehicles.
3. To evaluate the methods that have been used in forecasting (exploring) electric vehicles adoption in various countries. To design criteria that need to be met by such methods, given the nature of adoption and causal influences at hand.
4. To design a methodology for the exploration of future adoption of sustainable transport technology.

### ***Expected results:***

A set of methods for scanning the future of sustainable transport technology and a set of ingredients for improved content and process of adoption policies.

### ***Length of project:***

20 months

### ***Estimated project costs:***

\$ 110,000

### ***Proposed by:***

Dr. Marina van Geenhuizen, Delft University of Technology, The Netherlands



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Transport and urban sustainable development: the role of institutions.

### ***Statement of the problem to be examined:***

Although it is realized that institutional forces work on all spatial scale levels, the participants in the network prefer to develop research activity at the lowest level, i.e., the level of metropolitan areas.

A descriptive and explanatory analysis of the way cities (metropolitan areas) work in the implementation of sustainable transport policy (Agenda 21), with a strong focus on the influence of institutions and factors that lay behind. Both freight and passenger transport will be taken into consideration. An analysis of institutional change in favor of sustainable transport.

### ***Objectives:***

To develop local 'best practice', given particular institutional settings. To learn about the role of various actors, e.g., grass root organizations, other frontline actors (NGOs), and city planners, particularly how they influence the policy making process and policy outcomes.

### ***Research design or approach:***

One approach might be a contrast analysis of projects that are a deep failure and projects that qualify as a great success, with some projects in-between. It seems, however, too early in time to present a research design or approach. The participants prefer to think about detailed paths and approaches in the coming months, to communicate ideas via e-mail and to meet again at a later date.

### **Subscribers of the Network (March 13 1999)**

Caralampo Focas, Environment and Transport Studies, London, United Kingdom.  
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Marina van Geenhuizen, Delft University of Technology, Delft, The Netherlands (facilitator). E-mail: mariag@sepa.tudelft.nl

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## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Life styles and mobility

***Statement of the problem to be examined:***

Impact of life styles of different types of mobility ranging from residential and labour mobility to daily travel.

***Objectives:***

- (1) Multidimensional approach to identify 'life style'
- (2) Using life style to predict residential and labour mobility and daily travel
- (3) To forecast the effects of social change on life styles
- (4) To assess the sustainability implications of life styles

***Research design or approach:***

- (1) Estimation of life styles from empirical data (not using travel behaviour data):
  - a) multivariate analysis
  - b) microsimulation using fuzzy set theory
- (2) Modelling household formation, housing choice and daily mobility using microsimulation
- (3) Comparison between North America and Europe

***Expected results:***

Operational model and measures of the concepts and constructs developed.

***Length of project:***

36 months

***Estimated project costs:***

***Proposed by:***

Kay Axhausen, Viola Kahmann, Brian Mikelbank, Georg Rudinger, Ilan Salomon, Paul Waddell, Michael Wegener

# Conference on Social Change and Sustainable Transport

## Research Needs Statement

### *Descriptive title of project:*

Life styles of companies

### *Statement of the problem to be examined:*

We are quite ignorant as regards the 'why' of logistical decision making and its consequences for transport consumption. The logistical choices are influenced by a number of constraints: time, space, other chain members, marketing objectives, production capabilities, and so forth. Life styles are preferences on how persons and companies allocate their activities in time and space.

### *Objectives:*

- (1) To identify 'life styles' of companies for explaining differences in logistical decision making and transport consumption;
- (2) To use already developed research methodologies in the life style research and in passenger transport.
- (3) To draw parallels between passenger and freight transport and elaborate these ideas further.

### *Research design or approach:*

The research would involve drawing parallels between passenger and freight transport: life styles of persons to 'life styles' of companies; determined by age, sex, income of people to determined by company type, size; occupation etc. to type of product, etc.; household constrains/interactions to interactions within logistical chains; constraining degrees of freedom on travel decisions to marketing and production imposing logistical conditions; stage in life cycle to stage in logistical development.

### *Expected results:*

- a classification of firms: a typology of firms with different transport behaviour
- a better understanding of why logistical choices are made as they are
- policies to reduce transport vehicle kilometres targeted at specific market segments

### *Length of project:*

The first stage of the research (elaborating the parallels between passenger and freight transport) would not involve more than half a year. Data collection in later stages would be more time-consuming.

### *Estimated project costs:*

### *Proposed by:*

Gert-Jan Muilerman

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Tilting the balance: the psychology of unsustainable travel behaviour

### ***Statement of the problem to be examined:***

Psychological, social, cultural, communal and ethical factors lead to decisions on car ownership and related decisions on daily travel and housing location and type. The hypothesis is that these psychological factors influence the initial decisions, which are later reinforced by post-hoc justification and the resulting spatial structure by becoming established as habits or almost addictions. A further hypothesis is that changing transport and mobility decisions requires appealing to these underlying psychological factors.

### ***Objectives:***

To understand the factors that lead to initial decisions on car ownership and similar decisions on mobility and location and the factors that may lead to these decisions.

### ***Research design or approach:***

- (1) Comparative analysis of different groups of travellers facing important decision points such as driver license acquisition, auto ownership and change of residence or job:
  - Europeans v. North Americans
  - Youths v. adults (in particular Swedish youths in families of varying car ownership)
- (2) Examination of people's psychological attitudes and observed travel behaviour

### ***Expected results:***

- (1) Identification of psychological and social profiles (or survey questions) that can be used to explain the conflicting values that travellers must reconcile in order to make mobility decisions
- (2) An understanding of methodologies to change behaviour by re-examining these values. These values may inform the research agenda seeking to identify the 'life style' of travellers.

### ***Length of project:***

### ***Estimated project costs:***

### ***Proposed by:***

Birgitta Gatersleben, Scott Ramming, Karin Sandqvist

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Tele-activities, urban spatial form and travel behaviour - the example of mobile cellular technologies and new ways of living and working

***Statement of the problem to be examined:***

Tele-activities (working, consuming, learning, etc.) are now becoming more significant, but our understanding of their implications on travel and location is poorly understood

***Objectives:***

To examine mobile cellular technologies - as one example of a widely diffused technology in different cultural and urban contexts - in terms of how they are intersecting with new ways of living and working and what their implications on travel and location are.

***Research design or approach:***

- (1) Need initially for conceptual clarification, agreement over definitions and measurement parameters - probably through a workshop. To agree on a research design for empirical work.
- (2) Empirical investigations in different cities in North America and Europe

***Expected results:***

***Length of project:***

***Estimated project costs:***

***Proposed by:***

Ken Button, Andrew Gillespie (European chair), Mattias Höjer, Geneviève Guiliano, Guido Martinotti, Francesca Medda, Patricia Mokhtarian (US chair)

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

Mobility behaviour and ethical implications: transatlantic, comparative studies

### ***Statement of the problem to be examined:***

Social changes in mobility behaviour have to be based on an understanding of motivational factors and social action space. Motivations and social implications will probably differ significantly from one setting to another. On the other hand, one should expect certain anthropological and biological constants: mobility is a fundamental feature of nearly all life expressions. Transport research has hitherto done very little to investigate the nature of human mobility, both its more or less constant and its historically and culturally variable features. To catch up with this research field, interdisciplinary, qualitative research is necessary. A first study of this subject could focus on analysing the current mobility expressions in Europe and North America. To do this the following disciplines should be involved: transport psychology, sociology, anthropology and philosophy. The former will have to work mainly empirically, the latter will do most of the conceptual work and the work on ethical issues.

### ***Objectives:***

The objective of this joint research project is to provide planners, politicians and transport researchers with some basic facts on the motivational structure of human actors and on the ethical implications of mobility behaviour on human society and nature. These research results will improve the decision-making basis in questions of ecological and ethical sustainability (or Aliveability®).

### ***Research design or approach:***

The research is qualitative in nature. It aims at an improved understanding of certain basic mechanisms in people's mobility behaviour in a transatlantic context. The empirical part of the research undertaken by a psychologist, a sociologist and an anthropologist is based on case studies using qualitative methods such as ethnomethodology, on cultural-historical studies and on critical literature reviews. The philosophical part is based on common philosophical methods and selected phenomenological experiments. Furthermore, the philosophical researcher is responsible for the theoretical integration of interdisciplinary research.

As cases, three European and three North-American locations are selected, representing mobility conditions of three different kinds: the countryside, a small town and a metropolitan area. The empirical work is placed between two theoretical phases of research.

### ***Expected results:***

It is expected that the results will quality the decision-making in transport policy and the design of transport research in at least two ways: 1) the concept of sustainable mobility will be qualified as far as its social and ethical dimensions are examined; 2) the conditions for mobility changes will be explained by working out motivational factors and social and biological constraints.

### ***Length of project:***

The project is designed to last two years.

***Estimated project costs:***

Assuming that the work involves three researchers on full time basis the estimated costs, including travel expenses, etc. will be approximately

\$100,000

***Proposed by:***

Ulli Zeitler, PhD  
Senior researcher  
CESAM / Aarhus University  
Science Park  
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**Research collaboration:**

While I am interested in doing philosophical-ethical work, I am looking for transatlantic colleagues (psychologists, sociologist, anthropologists) who are willing to and able to perform the other empirical and theoretical work, preferably from Spring or Summer 2000 onwards. Maybe the Wuppertal Institute is interested? (Meike Spitzner, Martin Lanzendorf) or Georg Rudinger from Bonn University or Birgitta Gatersleben, University of Surrey? Who could be interested from the US or Canada?



## **Conference on Social Change and Sustainable Transport Research Needs Statement**

***Descriptive title of project:***

Sustainable transport and equity.

***Statement of the problem to be examined:***

Intra- and intergenerational justice being an essential element of sustainability have so far received only marginal attention in transport research.

***Objectives:***

The objective of this research proposal is to (1) clarify the concepts of equity and justice in relation to different aspects of transportation. (2) To investigate the implications for justice (external implications) of different economic and political instruments, such as of road pricing, gas taxes, physical planning, traffic regulation and so forth.

***Research design or approach:***

The project will be based on (1) theoretical, conceptual work and (2) empirical studies, which includes the contribution of a philosopher, a psychologist and a transport planner.

***Expected results:***

It is expected that the project will give a better decision-making basis for planners and politicians.

***Length of project:***

2 years

***Estimated project costs:***

\$100,000

***Proposed by:***

Ulli Zeitler, Aarhus University, Denmark

Participants at this conference who have related interests are:  
Joseph Szyliowicz and Eran Feitelson

## **Conference on Social Change and Sustainable Transport Research Needs Statement**

### ***Descriptive title of project:***

International assessment of transportation investment implications on physical activity and public health

### ***Statement of the problem to be examined:***

Recent studies by the U.S. Centers for Disease Control and Prevention (CDC) and The World Health Organization (WHO) indicate an increasing level of physical inactivity and growing incidence of chronic disease (U.S. Surgeon General's Report on Physical Inactivity, 1996). Contemporaneously, over the past 30 years, a significant shift has occurred away from non-motorized investment in favor of auto-oriented mobility (even for local non-work travel needs) resulting in reduced levels of physical activity from walking and biking.

### ***Objectives:***

To enable inter-regional comparisons to be made within and across differing institutional contexts regarding the levels of physical activity and frequency of chronic disease onset, as related to the expressed or absolute amount of non-motorized travel as a measure of physical activity. This research will inform policy makers of the public health implications of transportation investment in a variety of institutional contexts and will document the data needs to more fully integrate the study of travel behavior and household health and time use characteristics.

### ***Research design or approach***

This research will perform a comparative assessment of the relationships between the levels of physical activity and walkability of the built environment and expressed non-motorized transport occurring in differing physical and institutional settings. A cross-cultural assessment of the effects of the built environment, in terms of multi-modal transportation investment and urban form implications will be performed. This assessment will geographically integrate existing travel data, land use data, and public health data in a GIS environment. The analysis between household physical activity and attributes of the built environment will be cross-sectional, and will control for demographic and cultural factors that impact travel behavior. While the analysis will rely upon existing travel survey, land use, and household health datasets, it will also capitalize on other funded research underway. In particular, we proposed to supplement the current development of an Activity-based household travel survey in Atlanta (PI Lawrence Frank) with a more robust epidemiological model for a set of infill sampling locations. In addition, an outreach component of this effort will be targeted at the cross fertilization of ideas over gaining public awareness of the relationships between auto dependence and public health. Therefore, we will build upon the currently funded INPHORMM (Information and Publicity Helping the Objective of Reducing Motorised Mobility) research program at the University of Westminster..

### ***Expected Results:***

The establishment of a methodology to link land use, transportation investment, and physical activity; the development of a basic empirical assessment of how physical activity is related with the built environment within differing cultural and institutional settings; the documentation of data requirements to more fully model these inter-relationships; and the development of approaches to educate the public and decision makers over the effects of auto dependence on their health.

### ***Length of project:***

24 months

***Estimated project cost:***

\$325,000

***Proposed by:***

Lawrence D. Frank, Georgia Tech and Peter Jones, University of Westminster



## Chapter 5 Future Directions

The activities of SCAST were intended to identify salient transatlantic research questions and initiate proposals to examine these. The research needs statements in the previous chapter testify to the success of the former and there are indications that proposal activity has begun as well, but some problems remain. In this chapter I will address some of these problems and suggest some activities that will build on efforts to date.

It is relatively easy for scholars in North America and Europe to undertake research in their home countries. Joint transatlantic research is not nearly so easy for several reasons. Among these are the following:

1. The identification of research problems that are viewed as significant by both Europeans and Americans may be difficult. It is not that they disagree on this point, but the research priorities differ between the two.
2. If the Europeans or Americans come up with a problem they believe will be important to the other, they are often at a loss to identify who they could work with from the other side.
3. The logistics of working in a foreign area create some difficulties as domicile, equipment, and files are moved from place to place.
4. Language may very well be a problem for most U.S. scholars who venture to Europe. At the same time a substantial number of European researchers are fluent in English.
5. Data is never quite the same. Certainly there are data language problems, but these are minor. The more important questions relate to the meaning of the data. For example, in some countries a motor vehicle crash fatality is recorded if an individual dies within twenty-four hours. Beyond that time a different cause of death is given. So there are problems of data comparability.
6. Graduate students could move between the two continents, but this also creates administrative (primarily funding) problems.

SCAST sought to address some of these points, but others persist.

The success of SCAST may be short-lived on the U.S. side of the Atlantic. This is the case primarily because the entire effort was handled as an educational undertaking and the major problem with this approach is that younger scholars coming along and established researchers who did not become involved in the activities are, for the most part, unaware of SCAST and what it tried to accomplish. The same does not appear to be a problem in Europe.

## **The Need for an Organizational Structure**

On the European side there is a thematic network named NECTAR (Network on European Communications and Transport Activity) that keeps a large cadre of transport researchers aware of research funding opportunities and those working on specific problems. Interests of these scholars vary significantly, but they are for the most part social scientists interested in transport problems with a human dimension. When members of NECTAR want to interact with their American counterparts they end up usually talking with one or two scholars who may be familiar with work being done on the topic of interest, as opposed to a group where such information would be common knowledge.

It is proposed that researchers in the U.S. need to create an organization to interact with NECTAR on transatlantic social science - oriented transport research problems. It is true that geographers have a transportation group within the Association of American Geographers, but the group does not include a large number of active researchers. The Regional Science Association includes several active researchers in this area, but they lack any internal organization that is transport-related. There are numerous transportation trade organizations, but these usually have little interest in the type of research envisioned here.

The only group that currently comes close to satisfying the needs of transatlantic researchers is probably the Transportation Research Board (TRB) of the National Research Council in the United States. Of course the TRB is overwhelming in its size and scope (with more than 8,100 participants at its January 2000 meeting), but it may be possible to form a group (initially a task force and perhaps a standing committee in the long term) dedicated to research on transatlantic transport research problems. A major advantage of becoming a committee of TRB is that many researchers here and in Europe are already involved to some extent with this group. As a result, summer and annual meetings could simply be an add-on to their current participation at these meetings and this would keep the personal costs of attending under control. In addition, TRB provides a certain amount of staff support to its task forces and committees that would be advantageous for the group. Some exploratory activity with TRB will evaluate whether this is a viable approach.

Regardless of the organizational model arrived at, whether it is part of TRB or not, there is a clear need for this group to have an organization in North America that complements NECTAR and can interact with that latter group.

## **Proposed Activities**

In the future we would anticipate joint meetings between NECTAR and a complementary U.S. group. Aside from the positive intellectual benefits such joint meetings would bring, there are several activities that might be worth pursuing.

Workshops. There would be advantages to holding workshops with a topic that focused on the problems related to transatlantic research. For example, there are numerous transport - oriented geographic information systems in use in the U.S. (TransCAD, Arc Info) and Europe (NODUS), but little harmonization between these in terms of geographic and attribute databases and the

transferability of these between software. It would be useful to have a workshop on this topic for scholars working in the two areas. Other topics would include attempts to clarify differences in research findings between studies in North America and Europe (why are there differences in these study findings?), and clarification of the data compatibility problems, noted above, that will face researchers in the two areas.

Seminars. I believe the seminar format would be the best way of identifying salient transatlantic research problems. To achieve maximum benefit from such meetings researchers would be invited to participate in the examination of a list of potential research topics that would be distributed in advance probably by e-mail. Perhaps >brain-storming= might be a more apt description of these sessions where the best problems would be pursued and the others discarded. Outcomes of such sessions would include identification of an initial research design and potential scholars to be involved. These would be refined by further meetings with scholars specializing in the research area identified by the proposal.

Exchange Programs. An exchange program is envisioned that would result in North American and European graduate students on research support working abroad. Such a program would provide these future scholars with more insight into the nature and approach to research in the two areas and result in more interaction in future research than currently exists. Of course such exchanges could be undertaken by faculty, but the realities are a little more difficult in this case and programs such as the Fulbright Scholars could be used for this purpose.

Communication. All of the activities proposed could be communicated to Europeans and Americans making maximum use of contemporary technology. This would involve a combination of e-mail and Internet websites for the posting of information on research topics being developed into proposals, exchange opportunities, and a joint European-American transatlantic transport research newsletter with information of interest to participants in the U.S. and NECTAR groups.

## **Conclusion**

The success of SCAST leads one to conclude that there are some significant merits in continuing to build on its momentum. Problems exist in Europe and America that are quite similar, but are being approached quite differently. It is simplistic to say that the former favors policy and regulatory approaches, while the latter lives with the expectation that a technological fix will emerge. There is a need to go beyond this and try to identify the nature of the problems faced in the two areas and why solutions proposed are often completely different. The activities proposed here should increase our level of understanding in this area and even assist in answering some fundamental research questions.





## **APPENDICES**

**A. Participants in the workshops**

**B. Participants at the Berkeley Conference**

*Appendix A. Participants in the Workshops*

- Professor Richard Arnott  
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- Professor Yossi Berechman  
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- Professor Michel Beuthe  
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- Professor Patrick Bonnel  
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- David Boyce  
University of Illinois at Chicago (U.S.)*
- Professor Kenneth Button  
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- Christina Capineri  
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- J. Cuadrado-Roura  
Universidad de Alcala (Spain)*
- Professor Elizabeth A. Deakin  
University of California at Berkeley (U.S.)*
- Professor Gunnar Falkemark  
University of Gothenburg (Sweden)*
- Professor Andy Gillespie  
University of Newcastle (U.K.)*
- Professor Genevieve Giuliano  
University of Southern California (U.S.)*
- Dr. David L. Greene  
Oak Ridge National Laboratory (U.S.)*
- Professor Susan Hanson  
Clark University (U.S.)*
- Dr. J.W. Harrington  
National Science Foundation*
- Professor Kingsley Haynes  
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George Mason University (U.S.)*
- Professor David C. Hodge  
University of Washington (U.S.)*
- Professor Donald G. Janelle  
University of Western Ontario (Canada)*
- Professor Heli Koski  
University of Oulo (Finland)*
- Professor Jan Kowalski  
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- Dr. Thomas R. Leinbach  
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- Professor Lennart J. Lundquist  
University of Goteborg (Sweden)*
- Professor Guido Martinotti  
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- Professor Debbie Niemeier  
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The Ohio State University (U.S.)*

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*Professor Piet Rietveld  
Vrije Universiteit (The Netherlands)*

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George Mason University (U.S.)*

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*Appendix B. Participants at the Berkeley Conference*

- |  |  |
|--|--|
| <i>John S. Adams</i><br><i>University of Minnesota</i>                     | <i>Helen Couclelis</i><br><i>University of California -<br/>Santa Barbara</i>            |
| <i>Jillian Anable</i><br><i>Imperial College, London</i>                   | <i>Elizabeth Deakin</i><br><i>University of California -<br/>Berkeley</i>                |
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| <i>David Banister</i><br><i>University College London</i>                  | <i>Lena Eskilsson</i><br><i>University of Lund</i>                                       |
| <i>Jörg Beckmann</i><br><i>Kobenhavns Universitet</i>                      | <i>Eran Feitelson</i><br><i>The Hebrew University of Jerusalem</i>                       |
| <i>Michel Beuthe</i><br><i>Facultés Universitaires Catholiques de Mons</i> | <i>Jeff Fenstermacher</i><br><i>National Science Foundation</i>                          |
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| <i>Karin Book</i><br><i>University of Lund</i>                             | <i>Caralampo Focas</i><br><i>London Research Centre</i>                                  |
| <i>David Boyce</i><br><i>University of Illinois at Chicago</i>             | <i>Charlotta Frandberg</i><br><i>Göteborg University</i>                                 |
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| <i>Kenneth Button</i><br><i>George Mason University</i>                    | <i>William L. Garrison</i><br><i>University of California - Berkeley</i>                 |
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| <i>Stefano Carrese</i><br><i>Università di Roma Tre</i>                    | <i>Carsten Gertz</i><br><i>Technical University of Hamburg</i>                           |
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