# FUTURE URBAN TRANSPORT

## Problems and Solutions
## Interactive Conference
## Göteborg, Sweden,
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## Summaries of the conference presentations:
## Session 1 - Session 5

**Carsten Jahn Hansen**
**Lars Jacobson**
**Michael Möller**
**Anna Nilsson-Ehle**
**Peter Thormählen**
**Marie Thynell**

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# Summary of session 1

## *"History and geography of urban transport; some perspectives on human behaviour and the role of infrastructure"*

Summarised by Marie Thynell
*Göteborg University, Sweden*

## Introduction

The urban environment is usually associated with a variety of activities, which involve matching the demand for goods, commerce, services, rules and laws, culture and intellectual exchange. Proximity and congregation are essential factors when it comes to the economic efficiency of urban society. However, the attractiveness of urban environments has caused cites to expand without control in many areas, causing congestion, and environmental and social problems. This session deals with the complexity of urban settings, including the impact of large infrastructure projects relating to safety, noise, the environment and the future development of cities.

### *"The drive for mobility"*

**Professor Susan Hanson, Economic Geography, Clark University, USA**

Where does the desire for mobility emanate from – how is mobility generated? The first presentation discusses issues relating to urban transport and mobility in an historical context. Snapshots were shown illustrating a) the 19th century rural farmstead in which people had access without great mobility, b) the need for mobility in an old urban neighbourhood; Vintage 1920's-1960's, including much greater access to a greater range of more diverse goods and services with relatively low mobility. Movements were made mainly on foot or by bicycle, c) the next 'snapshot' was called California dreaming in which distances between establishments were longer and speed was higher. If you cannot move today, you do not have access. Having access requires high mobility because local access is poor and, finally, d) current trends are captured in the City of bits in which the effects of IT-driven development are largely unknown. This presentation continued by laying the stress upon the fact that transportation is woven into the fabric of everyday life.

Transport analysts have viewed congestion as a technical problem requiring a technical, engineering solution by means of increasing the network capacity – building more roads and lanes. The new facilities have been built with the aim of reducing travel friction and increasing the potential for people and vehicles to move about as rapidly as possible. The CATS, Chicago Area Transportation Study, from the 1950's was the first major metropolitan transportation study and it still dominates urban planning.

Changes in the urban societal context are related to:

- socio-demographic and equity issues
- increased participation in the design of transport systems
- the impact of IT
- health
- globalisation
- the rapid urbanisation of the developing world

- the environment
- sustainability
- increased sensitivity when dealing with place-to-place differences

Due to the complexity of transport and mobility, the area has to be understood in a holistic and integrated manner. Urbanisation is itself the outcome of a desire for accessibility. This desire has spawned a desire and a drive for mobility. The demand for transportation is a derived demand, based on the desire to participate in different activities. Transportation and land use patterns go hand in hand.

## *"Cities and their infrastructure - an historical perspective"*

**Professor Arne Kaijser, Royal Institute of Technology, Department of History of Science and Technology, Stockholm, Sweden**

Amsterdam and Chicago can be said to have been successful as cities in the sense that they have made better use of the opportunities inherent in their adopted infrasystems than has been the case in other cities. They grasped the potential of the new technology and commercial opportunities presented at that time and developed into important centres in local, regional and distance networks. The concepts of logistical revolution and infrasystems are crucial in this context. The first concept deals with the dramatic change to the prerequisites for commerce, industry and the spatial distribution of these activities which were brought about by the introduction of new infrasystems, such as systems of transportation, communication, energy, water, sewage and similar systems that move people, information and goods.

Today, another logistical revolution is taking place and the opportunities offered by information technologies will play a decisive role in future urban development. New technology can be used and combined in different ways and innovative urban regions and companies which are able to develop new conditions for future growth are likely to be the winners this time too. New solutions will, naturally, be of a different kind in Nairobi, Paris and Los Angeles. Three aspects of importance here are:

- Improve the efficiency of the existing system of transport
- Improve the co-ordination between the various forms of systems
- Enable a change of mobility patterns

Mergers between companies such as Volvo and Ericsson could be successful in order to develop new opportunities, as was once done in cities like Amsterdam and Chicago.

## *"Planning for transport and traffic in heterogeneous large cities in low income countries"*

**Dr Geetam Tiwari, Transportation Research and Injury Prevention Programme, Indian Institute of Technology, Delhi, India**

This presentation highlighted a number of topics primarily of relevance in densely-populated, low-income countries. They included the:

- very high rate of accidents and fatalities (one million/year)
- mismatch between road design and usage, i.e. a three-lane road is used as a two-lane road
- lack of public and safe transport
- the environmentally friendly ways of travelling are exposed to higher risks than the environmentally malign ones

- enlargement of transport facilities focuses on encouraging private cars and higher speeds
- huge amount of economic and other resources are spent on 'infrastructure improvement'
- 40-60% are poor and the design of street space and models for increased traffic do not take them into account

This increases chaotic situations and congestion, as well as air pollution and the rate of fatalities on the streets in urban areas. Meeting the travel demands of the inhabitants includes recognising the co-existence of multiple economies, each having its own characteristics, and is a prerequisite for sustainability. This is not a question of money. It is instead a question of importing ways of making plans and roads, and of understanding what needs to be done in developing contexts. The concepts behind today's infrastructure in developing countries were elaborated primarily in the USA and they simply do not correspond to the needs and the cultural contexts in cities like Delhi.

## *"Gender related effects on travel, energy consumption and environment"*

**Professor Anna-Lisa Lindén, Department of Sociology, Lund University, Sweden**

Statistical data from Sweden points to the fact that men travel longer distances than women. Women usually work closer to their home than men. Wealthy men and women have similar patterns of mobility and are therefore the most equal. Leisure travel accounts for 52% of Swedish mobility, work trips for 20% and other trips related to services for 23% (Resvaneundersökningen 1996). Distance travel is increasing. Lindén gives an account of various kinds of action, behaviour and their possible effect on lifestyles. For example, planned actions can change the habits of a person and indicate a change of lifestyle or reconsideration. They are also able to change patterns of behaviour and bring about lifestyle changes. Other examples were also presented. Habits established at a young age tend to be maintained throughout the individual life span. The social habits you acquire as a child tend to be remembered later on in life. Young people in families without a car are often experts on public transport and young people in motorised families do not manage to get around without a car and these experiences might influence travel behaviour later in life.

A number of conclusions were drawn from the Swedish studies. They include the facts
- that differences in energy consumption for transportation are explained by factors related to age, gender and income
- that elderly women are the only group within sustainable mobility limits in Sweden today
- that income influences both the amount of travel related to work and the amount of travel during leisure time. The higher the income, the longer the distance travelled. Men with high incomes consume more energy than all the other groups for their travel
- that the differences in energy consumption for travel among socio-economic groups are so large that they can be compared to the differences in resource use commonly found among average citizens in rich and poor countries

## *"Coping with complexity: the politics, environmental concerns, and aesthetics of large infrastructural projects"*

**Professor Tom P. Hughes, Distinguished Visiting Professor at M. I. T., USA**

In the 1950's, engineers, scientists and managers found the systems approach effective in managing physical and organisational complexity, especially in connection with military-funded projects, where they tackled a multitude of complex technical and social problems

plaguing the USA in the 1960's. They included the social and physical dilemmas of the large cities. The faith in the systems approach found at that time is expressed as follows:

> " . . . the techniques that are going to put a man on the Moon are going to be exactly the techniques that we are going to need to clean up our cities: the management techniques that are involved, the co-ordination of government and business, of scientists and engineers . . . the systems analysis that we have used in our space and aeronautics program - this is the approach that the modern city of America is going to need if it's going to become a liveable social institution. So maybe we've been pioneering in space only to save ourselves on Earth. As a matter of fact, maybe the nation that puts a man on the Moon is the nation that will put man on his feet first right here on Earth." (Vice President Hubert Humphrey, 1968).

The experts approached urban transport mechanistically and critical voices point to the fact that the goals were not clearly identified and that "managing a mess" should have been a proper way of dealing with the cities. History reveals a long list of difficulties, failures and mistakes in infrastructural projects. Hughes used the example of the Big Dig in Boston in order to illustrate the complexity of this kind of task and the kinds of mitigation that have been handled in order to proceed with the project. The rigid thinking present in many of the huge infrastructural projects have proven to be counter-productive in the USA and in other countries.

## Summary

All the presentations dealt with infrastructure and the impact of infrasystems upon mobility and related areas such as housing and work locations. Access and mobility, and the way access can be facilitated today were discussed. Efficiency in current infrasystems needs to be improved upon. The model for planning, which originates from the western countries, corresponds to the needs and visions inherent in modern, highly developed societies. Once the infrastructure, such as, a tunnel is finished, other alternatives are restrained. Examples from city planning in Stockholm were used to illustrate this phenomenon. The inertia associated with huge constructions inhibits the development of alternative solutions. The concepts behind today's infrastructure in developing countries emerged in the societal context of the USA and they simply do not correspond to needs in cities like Delhi and other mega-cities in low-income countries.

# Summary of Session 2

## *"Function and Efficiency of Transport"*

Summarised by Carsten Jahn Hansen
*Aalborg University, Denmark*

### Introduction

The focus of session 2 was the function and efficiency of transport and traffic in urban areas. This was to be seen in terms of "quality of life factors", "urban organisation", "functional demands", "information technology", "means and systems of transport" and "attraction factors of urban environment", for example.

Introduction by the session moderator, Professor Susan Hanson: It was emphasised that the session had a very international perspective with speakers from several countries. Furthermore, it was made clear that the session largely concerned issues relating to public transportation. This inevitably raised questions of equity, who pays, who benefits? This again raised questions about the relationships of publicly-funded transportation systems in an era of increasingly privatised transportation in many countries.

### *"A new transport and mobility plan for San Salvador"*

**Dr. Héctor Ricardo Silva, Mayor of San Salvador, El Salvador**

The focus was on the problems involved in dealing with public transportation systems in San Salvador. The city needs a rapid transport system – subsidised by the government. Ownership structures and the regulation of public transportation are currently some of the main problems. In addition, problems with street vendors taking up public road space were emphasised. The street vendors are now being moved to other places in the urban area. This is helping to solve transportation problems, but it raises problems of employment. Even so, it was stated that the benefits outweigh the problems.

When handling the problems of transportation, one question that was asked was, who is to deal with transport – the municipal government, the central government, or private enterprise? The creation of a metropolitan unit of transportation and the involvement of stakeholders (including the general public) were suggested. This would help to establish and ensure political consensus – it lends strength to the process of decision-making.

### *"Congestion, function and efficiency"*

**Professor Phil Goodwin, University College London, United Kingdom**

We are forced to accept that road, or road network, supply simply will not be matched to the potential demand. Instead, demand will have to be matched to supply through 1) the reduction and management of traffic levels by regulation, pricing or land use planning, 2) reversing the decline in public transport, 3) rediscovering walking and cycling, 4) an urban renaissance, reversing urban sprawl, the recreation of rich, dense and attractive cities. Next, three possible research issues were pointed out: 1) theoretical understanding of traffic reduction, 2) road pricing – knowledge of practice, implementation and experience, 3) new understanding of travel behaviour – in theory and practice.

On the issue of traffic reduction, the following questions were asked. What happens when action is taken to reduce traffic? Can experience acquired in town centres be extended outside town centres – and, if so, under what conditions and how? We do not as yet have an analytical understanding of the specific strategies, which will work best. On the issue of road pricing, it was emphasised that there are overall economic advantages if the full costs of traffic are charged for. Furthermore, the revenues from road pricing should be released and made visible to those affected by it – by subsidising public transport systems, for example. Finally, road pricing should give a city a competitive advantage in terms of quality and efficiency, greater than the competitive loss in terms of money.

The issue of sequence of policy implementation can become absolutely critical. Research on the order of implementation (of restraints on private cars and improvements for public transport, for example) is a key task. How can we improve our understanding of the underlying process of the way behavioural decisions and choices are influenced by the political process of defining and implementing policy instruments? We need concepts of change, of transition, of uncompleted processes, inertia, dependence, discontinuities, imperfectly reversible relationships, the dynamics of consensus formation and an emphasis on trajectory or pathway instead of end-state. Finally, it is more useful to consider how to make things better, rather than trying to define the optimum.

## *"Equity and efficiency considerations in the economics of large city transportation systems"*

**Professor Elliot D. Sclar, University of Columbia, NY, USA**

Governments should subsidise urban public transportation because of net social benefits, called positive externalities (such as environmental and economic). So, public transportation is more expensive, but it has greater aggregate external benefits. One solution is to establish a regional transportation authority, which transcends city/suburban boundaries. This poses an inherent political problem, which can be called the political economics of modal subsidy. The problem stems from the fact that people in different areas use different transportation modes – and spatial differences reflect social and economic differences. This again has led to political disputes (in the USA) over the mechanisms through which regional transportation is publicly financed – for example, the withdrawal of subsidies for urban mass transportation, law suits alleging that public finance schemes were racially and ethnically discriminatory. So, what is the proper basis for measuring equity? Here, much depends on the basic characteristics of the systems in question.

The political base for public subsidy has become more strained. Deregulation and privatisation pressures are undermining the viability of government as an active participant in the production of public services. The best solution will be a political-planning solution (not reflecting just a single rationality). A good political-planning resolution must address both efficiency and (horizontal and vertical) equity considerations. The future alternatives are to: 1) co-ordinate land use and transportation, 2) encourage high density co-location (older village design and new urbanism), 3) make expanding public transportation ridership the main objective in public policy. Finally, when it comes to finance policy, progressivity should be build into transportation taxes and appropriate levels for user charges (including peak load and distance pricing) should be found.

## *"City planning for the future"*

**Professor William J. Mitchell, Massachusetts Institute of Technology, MA, USA**

The focus was mainly on the relationship between new information technology systems and land use and transportation – how is information technology changing cities? These new ways of doing things add up to fundamental structural changes in the ways cities work and in the ways we need to think about planning. The new digital telecommunications infrastructure has complex spatial effects. Some bonds are broken (by buying music through the Internet, for example), others remain (getting a hair cut) and some new ones are starting to take effect. The consequence is a process called the fragmentation and recombination of familiar building types and urban development. We will see a redistribution of activities.

There will be a need to look for the driving forces that begin to take effect when traditional locational constraints are released because of telecommunication. For example, there will be interests of decentralisation and centralisation at the same time. So, who are the drivers in this development? What kind of new alliances will develop? The following research issues were suggested: 1) understanding fragmentation and recombination, 2) understanding interactions of telecommunications and e-life with land use and transportation, and 3) designing systems that combine both physical places and virtual places with transportation systems and telecommunication links.

## *"The Gothenburg public transportation system"*

**Mr. Roger Vahnberg, President, Västtrafik Göteborgsområdet AB, Sweden**

The major goal of the Gothenburg public transport system is to get more passengers, more passenger-kilometres for the money. The solutions have been to increase efficiency through competition and to increase cost-effectiveness and attraction by using information technology. In an attempt to make the bus transport service more effective, tenders have been accepted. The criteria for assessing the merits of the tenders were price, quantity, punctuality, quality and environmental aspects. As a result, about 30% of the costs were saved between 1991 and 1999.

Next, the use of information technology, the KomFram system, was explained. KomFram is an automatic system for gathering and processing data in the Gothenburg public transport system. This system uses real-time information at the stops, in the vehicles, for the drivers, for site-independent information, for the transport companies and for traffic management. In addition, the FlexRoute system was presented – this is a more flexible public transport solution based on passenger orders, also called a demand-responsive transport solution.

In conclusion, it was stated that we need a public transport system that enables short walking distances, fast trips and the freedom to choose departure times.

## *"The Curitiba urban transport system"*

**Mr. Fric Kerin, President, URBS, Brazil**

Curitiba has 1.6 million inhabitants – the metropolitan area has 2.4 million inhabitants. A public company is responsible for the planning, implementation and control of public transportation in Curitiba´s metropolitan area. The planning of Curitiba started in 1968 with a master plan for the city – central issues have been land use, the street network and public transportation. The first bus line started in 1974 and the objective has been to cover the city

over a radius of 30 kilometres from the city centre. Today, the results are exclusive lanes for buses, 10 bus terminals, high capacity bus lines (up to 16,000 passengers in each direction), interconnected districts, up to 1.8 million passengers a day and 400,000 vehicle-kilometres a day (in almost 2,000 buses). The bus system consists of many different bus sizes – some with a capacity of up to 270 passengers.

Every passenger uses 1.7 bus lines per day – and they only pay one fare. The first objective is a social objective – people living far away only pay one fare (50 US cents). There is no subsidy. Furthermore, the municipality operates none of the buses – the buses are operated by 10 private companies, paid by the kilometre. In conclusion, it was pointed out that buses are cheaper than other types of public transport, such as trams and trains.

### *"Civilising automobile transport – a challenge for Berlin"*

**Senator Peter Strieder, City of Berlin, Germany**

Given its unique historical situation after 1990, Berlin is both a latecomer to modernisation and the laboratory of modernity in one. Motor-vehicle oriented planning has destroyed urbanism and the vitality of our cities – it is time for reurbanisation and revitalisation. Three basic principles in urban policy were pointed out: 1) the preservation or restoration of quality of life in the city centre, 2) the guarantee of functionality, 3) the management of mobility, taking account of future ecological, technical, economic and societal demands and opportunities.

Those responsible for policy and planning must do justice to the various requirements of society with regard to transport planning, urban design and ecological aspects. A change in attitude and the use of public transport instead of private cars cannot be legislated for. It must be achieved through an attractive, high-quality and wide-ranging supply of public transport. This involves bus lanes, priority for buses and trams at traffic lights, short distances at transfer points, short waiting periods and acceptable fares. Finally, equal rights in the city's mobility must be restored to cyclists and pedestrians. We do not want to put cars at a disadvantage – basic mobility for each citizen has to be guaranteed.

## Summary

The session discussions mainly focused on road pricing, the use of information technology, public transportation, the involvement of stakeholders and the question of managing change.

During the discussion on road pricing, the following questions and issues were raised. Why has road pricing not been implemented until now? How can revenues from road pricing be used in the same policy context as the charges? How high do road pricing charges have to be in order to reduce traffic volumes? If local governments get permission to implement road pricing and collect the revenue – will they be too scared to use this instrument (as is the case at national level)? – going from having the will without the power, to having the power without the will? road pricing must be reinforced by a variety of other policy instruments – how?

On the issue of the use of information technology in relation to transportation, the following questions and topics came up. How does Internet trading affect local transport? Do we want trucks and vans in residential areas? Will information technology lead to more or less physical mobility in the future? Will teleworking reduce mobility – or will people just travel more for social and recreational purposes? What effect will the Global Positioning System (GPS) have?

How do we develop trustworthy and accountable systems? Information technology benefits can only outweigh the bad effects if transitions are managed well – how do we manage transitions without issues of equity getting out of hand?

The discussion on public transport raised these issues. Have people moved from the automobile to public transport – evidence of increased ridership in public transport? Bus fares and equity – a demand for lower prices in the developing countries? The World Bank encourages deregulation – which appears to lead to fragmentation – is there any place in the developing countries where the market has delivered an environmentally sound public transport system, or is not it possible without strong public sector involvement?

The discussion on the involvement of stakeholders and the public related to the following issues. The road lobby – how do they think, how can we change this? When you involve people and stakeholders, you must be sure to provide all the information – including the costs. Public participation – how do we create public acceptance?

On the more general issue of managing change, these issues came up. How do we understand change? How do we identify the kinds of change we want to encourage? Are the only effective ways a well-informed population and a high level of sophisticated critical discourse?

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# Summary of session 3

## *"Energy and environmental aspects"*

Summarised by Peter Thormählen
*Chalmers University of Technology, Sweden*

## Introduction

This session focused on the energy and environmental aspects of transportation. The presentations dealt with subjects like global climate changes due to $CO_2$ emissions and fine particles, noise from vehicles, energy resources, new energy systems and the future development of automobiles.

There are currently strong indications that the present use of fossil fuels will gradually lead to global climate changes. Because of this and for long-term sustainability reasons, the energy consumption per capita will have to decrease and become more even on a global scale. This will call for the development of more energy-efficient means of transportation and a transition to non-$CO_2$-emitting fuels.

### *"Global warming warnings call for $CO_2$ emission restrictions"*

**Professor Bert Bolin, Stockholm University, Sweden**

There is a need for further studies of the climatic changes. The increase in temperature during the last 100 years coincides with the increase in $CO_2$ concentration in the atmosphere, but nobody can say for sure whether this is a coincidence or not. Most scientists believe, however, that the temperature increase is due to human activities. The present climate models suggest a global temperature increase of 1-3°C to the year of 2050, but more research is needed to obtain greater accuracy. A temperature increase of this magnitude will lead to large local climate changes. Most probably the ice in the Polar regions will also melt, resulting in an increase in sea level of several metres. Today, between 20-25% of global $CO_2$ emissions originate from transportation, but in industrialised countries like the USA or Sweden the contribution is about 35-40%. The $CO_2$ concentration in the atmosphere needs to be stabilised at about 450-550 ppm, which means a reduction in the order of 60-80% in the industrialised countries. Methane is also believed to be responsible for global warming and a reduction in these emissions is therefore needed. The transport system must therefore be dramatically changed or the use of non-$CO_2$-emitting fuels must begin.

### *"Global scientific problems associated with fine particles"*

**Professor Robert Charlson, King Carl XVI Gustaf's Professor in Environmental Science, Sweden**

The changes in the global climate are not only an effect of the changes in $CO_2$ concentration in the atmosphere. The climate is also affected by the formation clouds, which block the incoming radiation from the sun. If a temperature increase leads to an increase in cloud formation, this could reduce some of the effects of the emission of greenhouse gases. Another factor affecting the climate is the release of fine particles into the atmosphere. Just like clouds, the particles block the light from the sun, leading to a decreasing temperature. When, for example, large amounts of particles are released from a volcano, this results in a global

temperature decrease. The life span of particles in the atmosphere (less than a year) is much shorter than the life span of $CO_2$ (decades). This means that a reduction in particle emissions to improve the local environment contributes to global warming after a short period, while it will take a long time for a reduction in $CO_2$ emissions to bring about a decrease in global warming. Since the reduction of $CO_2$ emissions will have such a large impact on industrial development, it is important that industry becomes involved in global climate research.

## *"Noise and waste of energy and waste of land in the urban areas"*

**Professor Tor Kihlman, Chalmers University of Technology, Sweden**

Noise from traffic is an environmental factor that affects most people in urban areas. Approximately 50% of the EU population is exposed to outdoor noise levels exceeding 55 dB, which should be compared with the long-term goal in Europe of outdoor levels below 55 dB. Even at these levels, most people are annoyed by the noise, and to have reasonable quietness indoors, it is necessary to keep the windows shut. The reduction of noise is, however, a very slow process and noise from traffic has only been reduced by 1-2 dB during the last 25 years. It is difficult to reduce the noise produced by traffic. An observation that has been made is that the noise level is almost independent of the city population density. Sprawling cities are no quieter than compact ones, which means that compact cities should be favoured as they are more efficient. The only reasonable solution appears to be the creation of "quiet zones" in urban areas. This can be achieved by using buildings as noise shields along traffic routes.

## *"Energy resources, feasible availability, developments and limitations"*

**Dr. James MacKenzie, Senior Associate, World Resources Institute, WA, USA**

Our society is currently highly dependent on oil as an energy source as it accounts for approximately 40% of the global energy supply (the rest is mainly coal and natural gas). Oil is also virtually the only energy source for transportation and is thereby the major source of greenhouse gases. Global oil resources are not, however, unlimited and at some point within the next few decades oil production will reach its maximum. Most estimates of the ultimate global oil resources are in the range of 1,800-2,200 billion barrels. Assuming that there is still another Saudi Arabia that is as yet undiscovered and will provide a total of 2,600 billion barrels, maximum production will be reached in around 2020. This future decrease in production can, however, be compensated for by the production of synthetic fuels from coal and natural gas. A substitution of this kind will increase the $CO_2$ emissions into the atmosphere and make the global warming problem even worse. The only reasonable solution would then be to start using non-$CO_2$-emitting fuels like hydrogen and start the development of new vehicles and infrastructure for these new fuels. More information about this topic can be found on the homepage of the World Resources Institute (http://www.wri.org/wri).

## *"Innovative fuel cells and energy systems"*

**Dr. J. Fraser Mustard, The Founders' Network, Toronto, Canada**

**(past Chairman of the Board, Ballard Power Systems)**

Fuel cells appear to be a promising technology in the development of vehicles for the future. Hydrogen currently appears to be the only realistic non-$CO_2$-emitting fuel and fuel cells are

probably the most efficient way to transform the hydrogen into useful energy in future vehicles. The performance of fuel cells is rapidly developing and there is a real hope that they will fulfil the necessary requirements in terms of size, power and manufacturing costs. The major obstacle to the automotive use of fuel cells is the storage of hydrogen in vehicles. Hydrogen is a highly flammable gas with quite a low energy content per unit of volume, which not only makes it difficult and space-demanding to store it in the vehicle, but also makes it difficult to handle it when transferring it to the vehicle at the fuel station. During a transitional period, it might be possible to use methanol as a fuel, which is converted to hydrogen on board the vehicle. Another problem to solve is how all the necessary hydrogen should be produced. It can be produced from water and electricity, but how should such large amounts of electricity be produced without using fossil fuels in the power plants when 90% of the global energy supply currently originates from fossil fuels? The only realistic solution is electricity from solar cells, if no major breakthrough is made in the area of fusion power.

### *"Environment and engineering for the future of automobiles"*

**Dr. Helen Petruskas, Vice President, Environmental and Safety Engineering, Ford Motor Co., Dearborn, USA**

The transport-related industry faces several challenges, such as air quality concerns, fuel resources that are visibly finite, and increased emissions and fuel economy requirements. Within the next 10-20 years, there will be a need for a ten-fold decrease in vehicle emissions and a two-fold increase in fuel efficiency compared with the present situation. More efficient computerised control systems and lighter vehicles will make it possible to reach this goal. Redesigning the electrical system from 12V to 42V will lead to further improvements in the fuel efficiency of the vehicle. In the longer perspective, there is a need for new technology, like battery or fuel cell vehicles, but large research efforts need to be made before this can be a subject for mass production.

## Summary

The most important question that needs to be answered in the immediate future is whether the release of $CO_2$ into the atmosphere, from the use of fossil fuels, leads to climate changes (the greenhouse effect). This means that research within this area must be highly prioritised. If continued research supports the idea that a greenhouse effect is created by human activities, the use of fossil fuels must then be cut by 60-80% on a global scale. This means that we need to start using non-$CO_2$-emitting fuels, develop the infrastructure for the production and distribution of these fuels and introduce new technology, like fuel cells, for vehicles. Public transportation systems also need to be improved in order to make them competitive compared with the use of private vehicles. One topic that was poorly covered during the conference was the transportation of goods. A large part of the present structure of industrialised production relies on access to cheap transportation systems for goods.

# Summary of session 4

## *"Safety aspects – prevention of traffic accidents and the care of injured persons in large urban areas"*

Summarised by Michael Möller
*Göteborg University, Sweden*

### Introduction

This session focused on traffic safety in urban areas. The presentations dealt with subjects such as urban crashes in the USA, accident epidemiology, traffic safety in developing countries, and shock and trauma emergency services.

Traffic accidents are a major threat to welfare in urban areas. Especially in developing countries, with a large number of unprotected road users, the number of accidents is very high. This call for the development of better designed traffic systems, which are adapted to local conditions.

### *"Setting the scene; A review of urban crashes in USA and potential countermeasures"*

**Dr. Brian O´Neill, President of Insurance Institute for Highway Safety, USA**

The scene was set by Dr. O´Neill, who started the 4th session by discussing urban crashes in the USA. Knowledge about car crashes is available, but the obstacle to implementing this knowledge appears to be the lack of political will and courage. Most car accidents occur in urban areas, but most fatalities are due to accidents outside the cities. Traffic light violations are the most common type of accidents, detected with the aid of cameras. Traffic engineering countermeasures can address this type of problem to a certain extent. Rear-end collisions are the main cause of neck pain. One-third of all insurance expenses go to this patient category.

### *"Accident epidemiology, automotive safety and developments in products and traffic"*

**Professor Murray Mackay, University of Birmingham, UK**

Professor MacKay discussed the incidence of fatal traffic accidents worldwide. The figures for traffic-related fatalities in the western world will remain at 150,000/year in 2020, as it was in 1990. In the developing world, the figures are expected to rise from 350,000 to 1,850,000 during the same period. Road traffic accidents will become one of the three main causes of disability in the third world within the next 20 years. The importance of performing analyses of whole traffic systems, including the traffic environment, drivers and vehicles, and their failures, was stressed. It is important to increase the attention that is paid to disabilities and not only fatalities caused by road traffic accidents. Studies are needed in the field of environmental problems, safety and mobility and the way these aspects depend on one another.

## *"Accident epidemiology and traffic safety in less wealthy cities"*

**Professor Dinesh Mohan, Indian Institute of Technology, New Delhi, India**

Professor Mohan introduced the unprotected road traffic user into the discussion. He identified many differences in the urban transport situation between the western world and the developing countries. In India, only 14% of all vehicles are cars compared with 88% in the USA. A country becomes a "car country" when the average yearly income reaches the level of the cost of a new car. This means that India has a long way to go before an increase in the percentage of cars among vehicles occurs. In a country with few cars, approximately 75% of those killed in road traffic accidents are unprotected road users such as pedestrians and cyclists. Despite this, most safety measures and traffic engineering have not been directed towards these groups. A high level of "original thinking for technological solutions" in future urban transport in the third world is needed. There is a challenge to construct cars and buses that cause fewer severe injuries among unprotected road users.

## *"Transport and traffic injuries and cost-benefit methodology for optimising efforts"*

**Professor Jeff Crandall, University of Virginia, VA, USA**

After the very important contribution from India, we turned to real high-technological science. Professor Crandall presented a recently developed computer simulation model for injury prediction and prevention. The damage to the patient and the cost to society increase dramatically as the degree of severity of the injury increases. The damage to the patient could, for instance, be calculated as a function of speed.

## *"Shock and trauma emergency services and systems for saving lives"*

**Professor Andrew Burgess, University of Maryland, MD, USA**

Professor Burgess shared his experience from a Level One Trauma Centre. He talked about shock and trauma emergency services from his personal experience as a leading orthopaedic trauma surgeon. His interest in injury prevention arose from the clinical practice of saving lives among those involved in severe road traffic accidents. The impressive Trauma Centre in Baltimore was discussed and demonstrated, including video sequences from real accidents. With good resources, trained personnel and modern facilities, lives can be saved but at a very high economic cost. As in the previous presentations, the fact that disability deserves more attention, was stressed. One well-known example is the appearance of severe lower limb injuries, especially foot injuries, in the era of the airbag.

## *"Society costs caused by traffic accident injuries"*

**Dr Ian Johnston, Managing Director, ARRB Transport Research, Australia**

Dr Johnston was the last speaker in this session and his topic was society costs of accidents. Dr Johnston stated that the safety problems are very much the same in different countries but the countermeasures differ widely. "Yet, the results are remarkably similar." A new era of searching for sustainability of health and safety aspects in urban transport has began and the way forward in the future has to include progress on different fronts simultaneously. Environmental aspects, social equity aspects, and health and safety aspects have to be taken

into consideration simultaneously, otherwise the safety aspects will lose their position as an area of high priority in traffic planning.

## Summary

Human behaviour and safety aspects were discussed. The term “sustainability” was used frequently. The conflict between safety and environmental aspects was addressed. The size of the car can be used as an example. A large car is safer as a rule, but it is not necessarily better for the environment. Furthermore, the car is safer for the driver but not necessarily for the pedestrian. The focus must be shifted from the driver to the unprotected road user. Most people killed in road traffic accidents, at least in India, are killed outside the car. The challenge is to deal with safety aspects for both the car user and the unprotected road users and to find sustainable solutions for the environment at the same time.

# Summary of session 5
## *"Critical issues for the future – needs and actions"*

Summarised by Peter Thormählen
*Chalmers University of Technology, Sweden*

## Introduction

This session focused on the process of making transport and traffic systems environmentally sustainable, more efficient and safer. The two presentations dealt with subjects such as political and structural obstacles to change, decision-making on different political levels and how to involve the general public in the development process. The presentations were followed by a long interactive debate, which is not summarised here, but is instead included in the summaries of the four previous sessions.

The development of transport and traffic systems can only be influenced by a combination of planning measures, restrictions, benefits, technological development, information and education. The key to successful development is therefore cross-border collaboration.

### *"Difficult choices"*

**Mr. Olgierd Dziekonski, Deputy Mayor, Warsaw, Poland**

There are several political and structural obstacles to implementing improvements to the present transport and traffic systems in a city. Decisions are made on different political levels and there could be conflicts of interests between them. The interests of the general public and commercial players must also be taken into account. One key issue is involving the general public in the development process. This is, however, a difficult task and further studies of how this can be put into practice are of great importance. Traffic planing must be treated as a regional issue, otherwise there will be conflicts between local interests resulting in sub-optimal decisions.

### *"Urban transport, the European dimension"*

**Mr. Kevin Leydon, Head of Unit, Clean Urban Transport, DG TREN, EC Commission**

Issues related to urban transport must be addressed on every political level (EU, national, regional and city) in order to bring about efficient decision-making. It is, however, difficult to reach common agreement on the goals for the future development of urban transport. Research on the process of reaching such an agreement is therefore important. There is almost always a conflict between what people want and what is best for society as a whole. In order to make a fair trade-off between different interests, decisions must be based on reliable information. Information of this kind is difficult to obtain; for instance, the costs of traffic congestion are difficult to measure.

## Summary

In order to achieve efficient control of the development process for urban transport, the subject must be addressed on every political level. In order to be successful, the general public must also be involved in the development process. One of the major problems, however, is reaching common agreement on the future goals.