

SUSTAINABLE ROADS – INTEGRATED PARTS OF THE TRANSPORT CHAIN IN A WORLD OF GLOBALISATION

19th September 2007 (am)

STRATEGIC THEME 2

INTRODUCTORY REPORT

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EXECUTIVE SUMMARY

Requirements on transport systems are changing very rapidly around the world. It will be particularly important to meet these requirements within the overall goal of sustainability.

A sustainable transport system ensures an improved material standard of living in terms of economic wealth, improves the general quality of life in terms of ecological liability, and shares the benefit of transport equitably among all sections of the community in terms of social fairness.

Over the past years sustainability has already been discussed in that context. And many countries of this world have already included the goal of sustainability into their planning, construction, operation and maintenance of roads. In particular, the idea of a comprehensive transport planning – including all modes of transport from the beginning of the process – is most promising. But there are many requirements still to be tackled on the route to an environmentally respectful and socially just development.

This report gives an overview on the questions that will most definitely challenge the transport sector in the future – such as on economic globalisation, demographic changes and measures to mitigate the expected climate change.

Economic relations are changing very rapidly around the world. Various regions undergo a fast development process which is connected to economic growth and increasing trade relations. Intensive competition and a globally open market leads to a relocation of production sites and, thus, to new traffic flows around the world. The report deals with some promising solutions such as the focus of some few strategic corridors – not forgetting the impacts of such a concentration in funding and further requirements emerge from that development.

In many states of the world demographic changes emerge which will have influence on the transport infrastructure. Some of the industrial countries report a need to cope with the structural changes in the society – primarily the ageing process. On the other hand the world is facing major migration streams and high birth-rates in developing countries. The impact of such a development on transport systems is discussed in this report – identifying a number of questions for future discussions.

Last but not least, the climate change has reached a new quality in the public awareness all over the world. The issue of CO₂ reduction is already a major aspect of an environmental sustainability. The road transport sector also needs to contribute to that goal. This report starts a discussion on the kind of that contribution, e.g. technical and monetary measures as well as traffic management and user behavioural aspects.

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1. INTRODUCTION

Following the World Bank definition of transport sustainability (see *World Bank 1996*), transport policy must satisfy three main requirements in order to be effective.

1. It must ensure that a continuing capability exists to support an improved material standard of living. This corresponds to the concept of economic and financial sustainability.
2. It must generate the greatest possible improvement in the general quality of life, not merely an increase in traded goods. This relates to the concept of environmental and ecological sustainability.
3. The benefits that transport produces must be shared equitably by all sections of the community. This we term social sustainability.

Following these principles, sustainability has already become a major goal of political programs and many national development schemes over the past years.

The report will first, in Chapter 2, have a look on the achievements of a sustainable road planning - not forgetting about the remaining challenges to face..

A changing world always sets new demands on the existing planning strategies. The idea of open markets has led to more vivid trade relations between countries. The discussion of how to cope with the demands of this economic globalisation in a sustainable way will be a major task in the future. Therefore Chapter 3 "**TRANSPORT CHAINS AND CORRIDORS IN A WORLD OF GLOBALISATION**" will have a closer look on the consequences of such a development, promising approaches and open questions.

The demographic characteristics of the population are changing all over the world. In many developing countries high birth rates can be observed, on the other hand an increasing ageing of the population in some industrialised countries is expected in the future. These developments have both consequences on road infrastructure. Chapter 4 "**CONSEQUENCES OF THE DEMOGRAPHIC PROCESS ON ROAD INFRASTRUCTURE**" is dealing with the questions of a sustainable handling of these challenges.

Last but not least, there are still a number of open questions about the "**IMPACT OF ROADS ON QUALITY OF LIFE**". Against the background of the recent discussion on climate change the topic of CO₂ emissions is discussed in Chapter 5.

2. SUSTAINABLE ROADS – ACHIEVEMENTS AND REMAINING CHALLENGES

Road transport is definitely one of the major transport modes but it can be said today that a sustainable development does not only start with the question of how to make road transport sustainable. A comprehensive approach in transport planning is the basis for a sustainable development. This means that the various transport modes should not be dealt with separately in the strategic planning process. The identification of transport needs and the definition of transport corridors to fulfil these needs are a first step of a sustainable transport planning. Within those identified corridors different transport modes can carry the load of traffic. The distribution of the demand on the different modes in a corridor is one of the challenges of sustainable planning. Furthermore, the experience of bundling different modes in a corridor has shown some good effects to mitigate the negative impacts of traffic in a whole such as e.g. noise pollution.

These ideas of a comprehensive intermodal planning have been included in a number of national transportation plans.

For instance, the government of the Federal Republic of **Germany** presented a strategy for the implementation of its sustainable development concept in 2002. In 2003, the Federal Transport Infrastructure Plan (BVWP) has been adopted, which serves as an investment plan as well as a planning tool. In accordance to the BVWP, the Federal Ministry of Transport, Building, and Urban Affairs (BMVBS) is striving for sustainable solutions that will ensure long-term mobility, are economically viable and socially just, and simultaneously respect the environment. This has led to a new generation of traffic plans, the so-called 'integrated comprehensive transport plans', at all regional authority levels.

In **Spain**, the Strategic Infrastructure and Transport Plan (PEIT) as the strategic planning instrument passed by the Spanish Government in 2005 and amounts to an unequivocal commitment to sustainable mobility. The PEIT lays down the execution of a number of sectoral, intermodal or territorial concertation plans, each needing to be adapted to the requirements of the regulations applicable, including drawing up a Strategic Environmental Sustainability Report in accordance with European Directive 2001/42/EC.

The National Assembly of the Republic of **Slovenia** adopted the Transport Policy Resolution in 2006. By means of this Resolution Slovenia started to implement the principle of a sustainable mobility. This means that transport systems must meet economic, social and environmental needs of the society, while, simultaneously, their undesired impacts must be reduced. This has led to an attempt of Slovenia to use an integrated approach in planning its transport infrastructure development. The approach takes into account the existing transport demand as well as definite development and protection aspects.

Romania has set out a highway building program on medium and long term, concretised by its inclusion in the Plan for Arranging the National Territory (P.A.T.N.), endorsed by the law in 2006. The present technical condition of the national road network, which takes over an important share of the traffic, is very poor on most of its length, which determined the promotion of a national rehabilitation program to bring it to the international operational standards, to meet the requirements of the users from the point of view of comfort, safety and efficiency of movement. The adopted technical solutions took into account the aspects imposed by the sustainable development, both in point of the adaptability to subsequent interventions, and concerning the impact upon the environment.

In the **Republic of Congo**, the government adopted a number of strategic objectives to cope with the negative impact of the desolate state of road network on social life and eco-

nomics, such as the development of hinterland, the reduction of transport costs inland as well as to neighbouring countries, the accessibility of roads in all seasons etc.

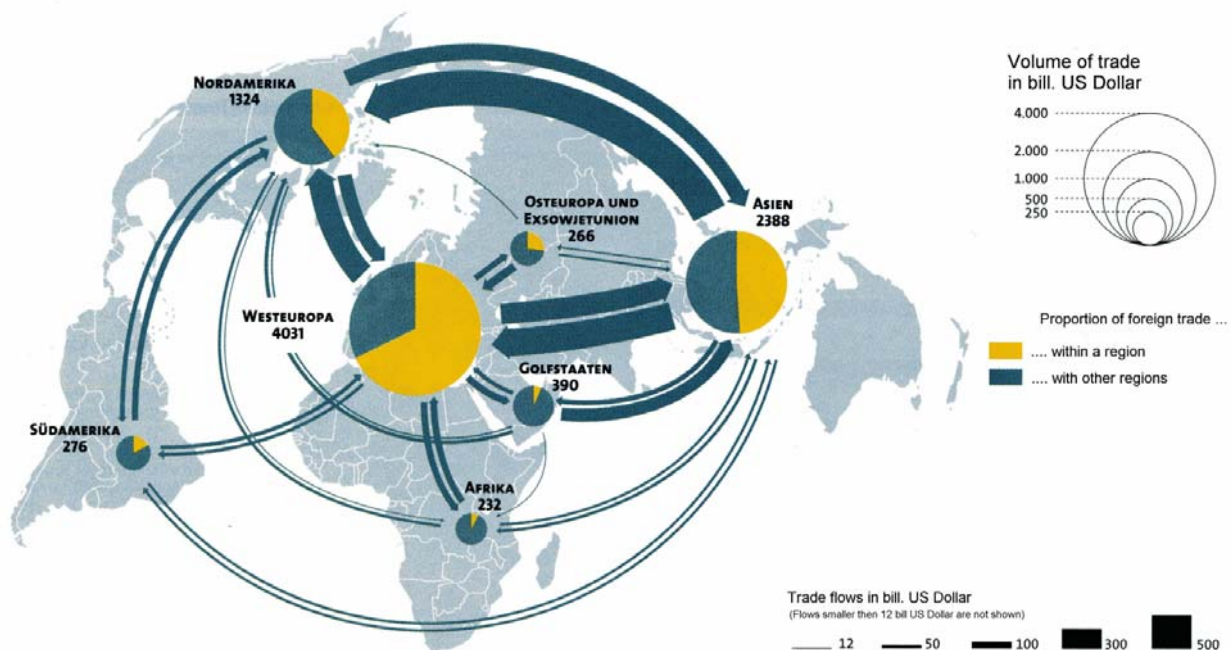
The Federal Office for Roads of **Switzerland** developed 2001 an instrument, which enables the evaluation of road infrastructure projects with consideration of the sustainable goals. This project is called NISTRA. NISTRA is based on “the goal and indicator system sustainable traffic” and evaluates a project on the basis 40 indicators from the ranges environment, economics and society. These indicators are partially in cost-benefit terms, partially quantified and partially represented qualitatively. The different partial results are consolidated consciously not only in one yardstick, but made transparent in a clear tableau. Thereby interest conflicts become visible which are significant for the projects. Thus NISTRA supplies decision makers and creates the data, which are based on the concept of the sustainability to simplify political consideration processes.

To conclude,

although many countries of this world have already included the goal of sustainability into their planning, construction and operation of roads today, there are many requirements still to be tackled on the route to an environmentally respectful and socially just development. It can be noted that countries that are just about to enter global market attach more importance to a fast upgrading of their road networks in order to cope with traffic demand while industrial countries make a greater effort with tackling congestion on the existing networks within the limits of social and environmental requirements. Especially the idea of an comprehensive intermodal approach for a strategic transport planning should be followed up with and introduced especially to the developing countries.

3. TRANSPORT CHAINS AND CORRIDORS IN A WORLD OF GLOBALISATION

3.1. Consequences of economic growth and increasing trade relations around the world
 Economic relations are changing very rapidly around the world. Various regions undergo a rapid development process which is connected to economic growth and increasing trade relations. Intensive competition and a globally open market leads to a relocation of production sites and, thus, to new traffic flows around the world. One very recent example is that in 2004 total trade of Japan with China surpassed Japan's trade with the US and China became Japan's largest trading partner. This and other examples show the dynamics in trade relations and their foreseeable consequences.



World Trade Relations (see "Atlas der Globalisierung" – translated into english)

The figure of World Trade Relations shows that interregional trade as well as intercontinental trade has a notably proportion of the total external trade of the nations. There is an increasing number of intercontinental and international transport corridors involving all transport modes. All over the world, freight transport is expected to grow continuously, especially for long-distance traffic.

Economic agreements between countries are the basis for free trade and cross-border interactions. Therefore political and economic communities gain in importance all over the world. Quite a number of those associations have only been formed in recent years or have been revived after wars and political crises. So it can be expected that the trade relation will even grow in the upcoming years. The following table gives examples of major regional blocks, usually founded as trade agreements.

Regional block ¹		Area (km²)	Population	GDP (PPP) (\$US)		No. Member states¹	Year founded
				in millions	per capita		
EU	European Union	4,325,675	496,198,605	12,025,415	24,235	27	1992 (1957)
SAARC	South Asian Association for Regional Cooperation	5,136,740	1,467,255,669	4,074,031	2,777	8	1985
CSN	South American Community of Nations	17,339,153	370,158,470	2,868,430	7,749	10	expected in 2007
ASEAN	Association of Southeast Asian Nations	4,400,000	553,900,000	2,172,000	4,044	10	1967
NAFTA	North American Free Trade Agreement	21,588,638	430,495,039	15,279,000	35,491	3	1992
EurAsEC	Eurasian Economic Community	20,789,100	208,067,618	1,689,137	8,118	6	2001
ECOWAS	Economic Community of West African States	5,112,903	251,646,263	342,519	1,361	15	1975
SACU	Southern African Customs Union	2,693,418	51,055,878	541,433	10,605	5	1910
GCC	Co-operation Council for the Arab States of the Gulf	2,285,844	35,869,438	536,223	14,949	6	1981
COMESA	Common Market for Eastern and Southern Africa	3,779,427	118,950,321	141,962	1,193	5	1994 (1981)
Agadir	Free Trade Zone between the Arabic Mediterranean Nations	1,703,910	126,066,286	513,674	4,075	4	2004
CEMAC	Economic and Monetary Community of Central Africa	3,020,142	34,970,529	85,136	2,435	6	1999
CARICOM	Caribbean Community	462,344	14,565,083	64,219	4,409	14+1 ³	1973
EAC	East African Community	1,763,777	97,865,428	104,239	1,065	3	2001 (1967)
CACM	Central American Common Market	422,614	37,816,598	159,536	4,219	5	1991 (1960)
PARTA	Pacific Islands Forum	528,151	7,810,905	23,074	2,954	12+2 ³	1971
EFTA	European Free Trade Association	529,600	12,233,467	471,547	38,546	4	1960
Reference blocks and countries ²		Area (km²)	Population	GDP (PPP) (\$US)		Political divisions	
				in millions	per capita		
	UN	133,178,011	6,411,682,270	55,167,630	8,604	192	
	Germany	357,050	82,438,000	2,585,000	31,400	16	
	Japan	377,873	128,085,000	4,220,000	33,100	47	
	Canada	9,984,670	32,507,874	1,165,000	35,200	13	
	Indonesia	1,904,569	234,300,000	935,000	4,000	33	
	Brazil	8,514,877	187,560,000	1,616,000	8,600	27	
	Russia	17,075,200	143,782,338	1,723,000	12,100	89	
	India	3,287,590	1,102,600,000	4,042,000	3,700	35	
	China (PRC) ⁴	9,596,960	1,306,847,624	10,000,000	7,600	33	
	USA	9,631,418	300,000,000	12,980,000	43,500	50	

¹ Including data only for full and most active members
² The first five states in the World by area, population and GDP (PPP)
³ Including non-sovereign autonomous entities of other states
⁴ Data for the People's Republic of China does not include Hong Kong, Macau and regions administered by the Republic of China (Taiwan).

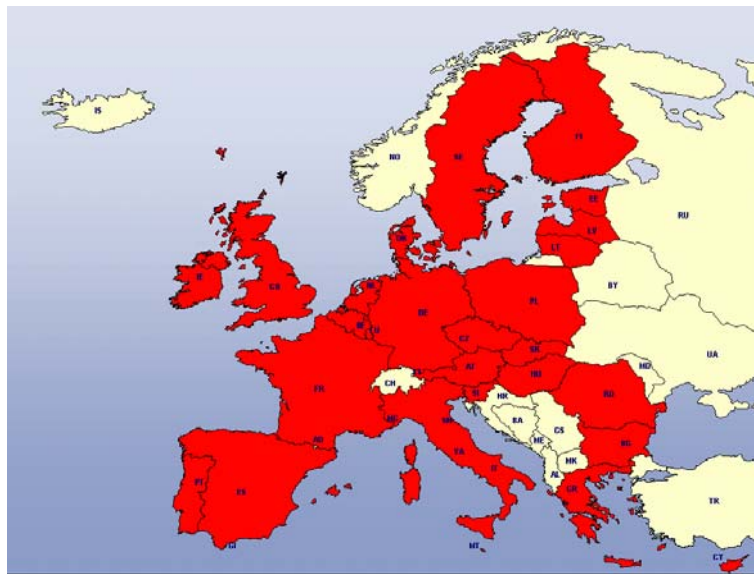
Examples of regional blocks as trade areas (Figures based 2004)

[Source: Wikipedia, the free encyclopaedia, http://en.wikipedia.org/wiki/Trade_block based on The world factbook, Central Intelligence Agency (USA) and International Monetary Fund (IMF)]

The following paragraphs have a deeper look into those associations mentioned in the national reports. They can be seen as an example for conditions and approaches in other areas, too.

The enlargement of the European Union

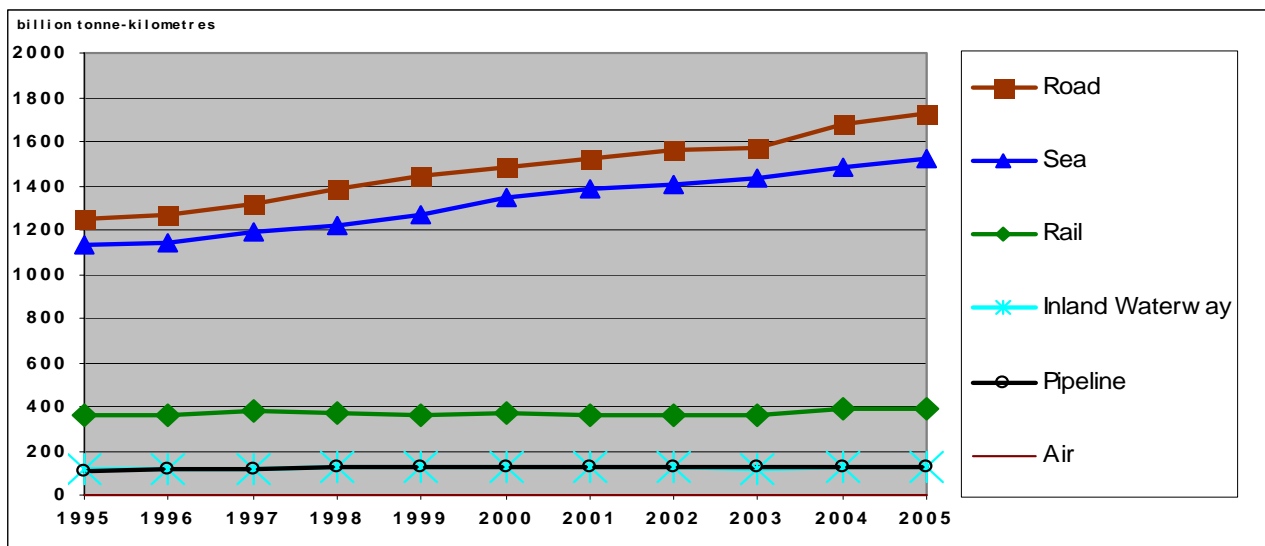
Europe is expanding and its economic links are growing ever faster. In 1951, only six countries – Belgium, Germany, France, Italy, Luxembourg and the Netherlands – founded the European Coal and Steel Community, followed by the European Economic Community and the European Atomic Energy Community in 1957. The EU was established in 1992 by the Treaty on European Union (The Maastricht Treaty), and is the de facto successor to the European Economic Community of 1957. Five successful enlargements have followed since then: Denmark, Ireland and the United Kingdom (1973), Greece (1981), Spain and Portugal (1986), Austria, Finland and Sweden (1995). In 2004, the EU underwent a historic enlargement to 10 countries of Central and Eastern Europe and the Mediterranean: Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia and Slovenia. It was a unique, historic enlargement which signified the re-unification of Europe after decades of division by an Iron Curtain. The accession of Romania and Bulgaria on the 1 January 2007 completed the fifth enlargement of the EU that had started in May 2004.



The 27 Member States of the European Union in January 2007

Freight transport in Europe

Consequently, with the establishment of a common market in the EU, freight transport in Europe will continue to increase, whereby the lion's share of freight will be transported by road (see Figure "EU-25 Performance by Mode for Freight Transport 1995 – 2005").



EU-25* Performance by Mode for Freight Transport 1995 – 2005
(see *Energy & transport in figures 2006*)

As a transit country in the middle of Europe, **Germany** has a particularly important role to play in this regard. In 2003, approximately 5.6 billion tons of freight were transported within Germany while freight traffic amounted to 516.5 billion ton-kilometres (see *Verkehr in Zahlen 2004/2005*). Both in terms of traffic volume and the amount of goods transported, much more freight is transported by road than by any other mode of transport.

The following can be said about road freight transport involving German trucks (see *Güterverkehrstatistik*): in 2005, German trucks with a legal gross weight of > 3.5 t transported 2.7 billion t of freight. Over the past ten years, traffic volume has increased from approximately 238 million tkm in 1995 to approximately 310 million tkm. While most freight is transported locally, most traffic volume is generated over long distances. The trend in recent years shows that traffic volumes for long-distance traffic have increased while traffic volumes at regional and local level remain virtually unchanged.

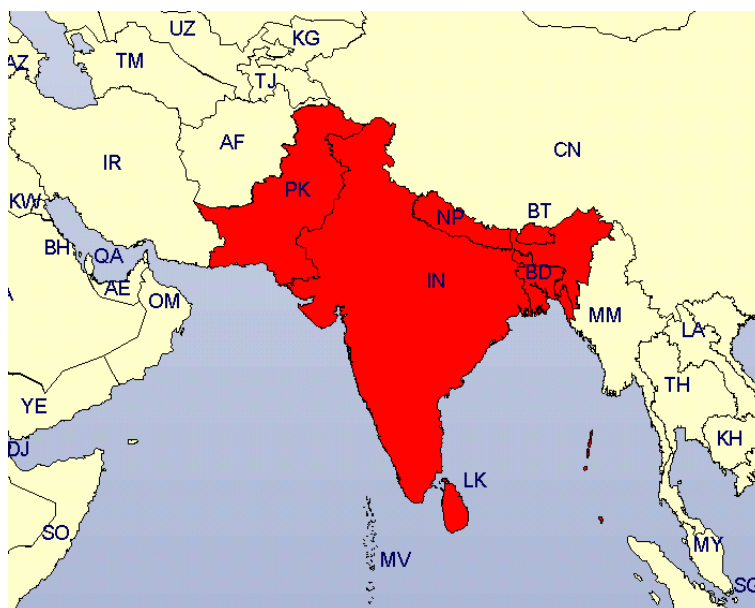
In **Spain**, the annual volume of road haulage between the Iberian Peninsula and the rest of Europe across the Pyrenees is currently approaching the 100 million tons mark in both directions. It has recorded an average growth since 1986 (the year Spain joined the European Economic Community) of 8% p.a., meaning that it doubles itself every ten years.

From 1988 to 2004, the traffic intensity on the **Romania's** national roads has increase significantly, on the European national roads by 87%, on the national trunk roads by 62% and on the national secondary roads by 66%. At the level of the year 2005, the anticipated data show high traffic values on the networks converging towards the main cities, respectively values over the daily annual average of 8,000 or 16,000 physical vehicles/24 hours (on the roads with 2, respectively 4 traffic lanes), at the entrance and exit in and from the main urban agglomerations (Bucharest, Ploiesti, Timisoara, Brasov, Constanta, etc.). The further increase of the traffic on the national road network is foreseen in steps of 5 to 7% every year.

* Belgium, Germany, France, Italy, Luxembourg, the Netherlands, Denmark, Ireland, the United Kingdom, Greece, Spain, Portugal, Austria, Finland, Sweden, Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia, Slovenia

The South Asian Association for Regional Cooperation (SAARC)

The South Asian Association for Regional Cooperation (SAARC) was established in 1985 by the Heads of State or Government of Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. SAARC provides a platform for the peoples of South Asia to "work together in a spirit of friendship, trust and understanding". It aims to accelerate the process of economic and social development in Member States. (see SAARC official Homepage <http://www.saarc-sec.org>)



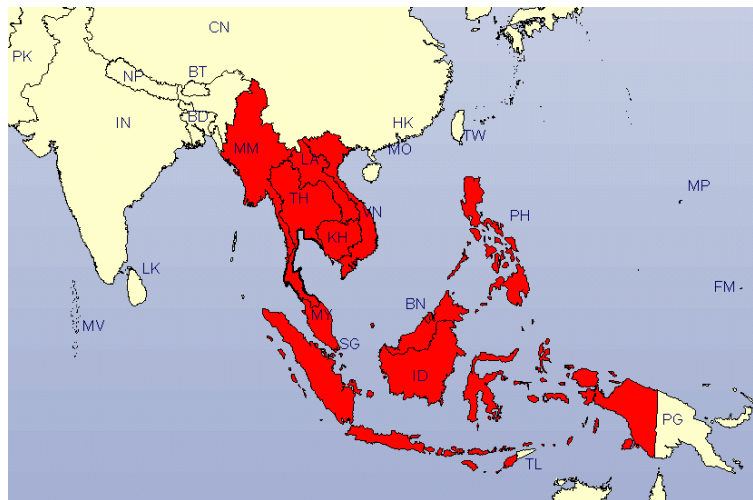
SAARC Member States

Trade between **Bangladesh** and rest of the world has shown strong growth since 1995. The average export growth since 1985 has been 11.4 per cent, while the average import growth was 7.6 per cent. Recently, the average export growth has further increased to 12.9 per cent and the import growth declined to 5.0 per cent. Bangladesh's trade with SAARC countries represents one-third of the value of its trade with rest of the world, which is mostly happening by border trade as traffic-in-transit arrangement with neighbouring countries. It is found that there are 181 border posts (land custom stations) around the international borders of Bangladesh. Government policy is to improve both international trade and passenger movement through these land ports with neighbouring countries. In this circumstance, the government has established the Bangladesh Land Port Authority (BLPA) and declared 13 existing border posts as land port through gazette notification in January 2002.

Association of Southeast Asian Nations (ASEAN)

ASEAN was founded by five states, mostly from maritime Southeast Asia: the Philippines, Indonesia, Malaysia, Singapore, and Thailand, in 1967. The British protectorate of Brunei joined ASEAN after the country became independent from the United Kingdom in 1984. The mainland states of Vietnam, Laos, and Myanmar were later admitted. Vietnam joined ASEAN in 1995, while Laos and Myanmar were admitted into ASEAN in 1997. Cambodia

became the newest member when it was admitted in 1999. The ASEAN region has a population of about 500 million, a total area of 4.5 million square kilometres, a combined gross domestic product of almost US\$ 700 billion, and a total trade of about US\$ 850 billion. (see ASEAN official Homepage <http://www.aseansec.org>)



ASEAN Member States

In recent years the economic links between **Japan** and East Asia have deepened along with their booming economy, as symbolised in particular by the Chinese economy. In the past, the US were Japan's most important trading partner for both imports and exports, but in 2004 total trade with China surpassed the US and China became Japan's largest trading partner. Total trade with China in 2005 amounted to 25 trillion yen, while trade with the US was 21.9 trillion yen, and trade with the countries of the Association of Southeast Asian Nations (ASEAN) was 16.4 trillion yen. Trade relations between Asia and Japan will continue to grow in the future, and it is expected that mutual dependency will further deepen.

To conclude,

the establishment of economic treaties and trade agreements all over the world have major impacts on the foreign goods trade – already today and even more in the future. These developments give clear evidence of the increasing importance of the interregional and international transport networks to economic development. Apparently, there is an eminent need of all countries to work together.

3.2. Examples of transport chains and corridors

The trans-European transport network

In order to allow goods and people to circulate quickly and easily between the European Member States, missing links must be built and bottlenecks must be removed in the transport infrastructure. In contributing to the implementation and development of an internal market, as well as re-enforcing economic and social cohesion, the construction of a trans-European transport network is a major element in economic competitiveness and a balanced and sustainable development of the European Union. In April 2004 the EU adopted a plan that focused investments on a limited number of major trans-European transport axes (see Map of the 30 priority axes and projects). In particular, the plan aimed at integrating the networks of the new EU Member states, thereby contributing to a stronger Single Market.

Although some of the projects to realise the trans-European transport network are already under construction it will be a major challenge to achieve the goals for the next 10-15 years.



Map of the 30 priority axes and projects of the trans-European transport network (see "TEN-T priority axes and projects 2005")

In **Spain**, the current levels of congestion and the saturation forecast for the near future affects the general principle of sustainable mobility and triggers the need to rebalance the transport system by promoting both rail and short sea shipping modes and to develop the so-called "sea motorways". The sea motorway concept appears as a priority action in the latest review of the Trans-European Networks (TENs), passed by co-decision of the European Parliament and the Council of Europe in April, 2004. Since that time and after a relevant consultation period, the European Commission has drawn up a vade mecum containing a series of criteria for the launch of sea motorways eligible for receiving public aid through the Tender Procedure in Member States.

According to the Decree of the **Hungarian** Government, a network of motorways and expressways totalling 2420 km is planned to be built by the end of year 2015. The density of this network will be about 26 km per 1000 km², very near to the forecast value characterising the similar network of the former EU15 Member States by that time. The main elements of that network in Hungary are planned along the Pan-European transport corridors. The impact of better roads on economic output can be observed in Hungary too, where the extension of the motorway network between 1995 and 1998 has contributed to attract foreign capital investments into the Central and Western regions of the country, while offering better opportunities to settle down modern industries and services in the Eastern regions as well. Due to the extension of the motorway network between 1996 and 2006, average travel times by road between the capital city and most of the county towns have shown a considerable decrease, especially in the Eastern regions of the country. The geographic situation of the country being on the crossroads of freight transport flows between Western and Central Europe and the Balkans or the Near-East, is favourable and provides great advantages. To make real use of this favourable position – considering also environmental issues – appropriate intermodal logistics infrastructures and services have to be made available in due time. These well functioning service elements could contribute to generate new demand and connect different modes of freight transport.

In the context of the integration of **Romania** to the European Union, a pressing necessity is to bring the road transportation network to the level of performance compatible with the other European countries in the Union. This situation generated the elaboration of strategies for building the national highway network, respectively for rehabilitating the paved roads and for paving the local roads. The programs in view took into consideration the integration of the road network, as part of the national transportation system, in the development strategy of the European road transportation system.

Slovenia's position at the crossroads of the Fifth and Tenth Transport Corridor ensures the conditions for the integration of the country into the European transport system. The motorway construction in these corridors is in its final phase and the missing railway link to Hungary has been completed.

The Japanese distribution backbone network

The Japanese government made a cabinet decision in November 2005 for a comprehensive distribution network (2005 to 2009). Among various measures proposed, to strengthen international competitiveness, it called for building a distribution network in Japan and overseas that can link land, sea, and air transportation modes. The selection of the international distribution backbone network started with identifying approximately 29,000 km of the trunk road network currently in service, including high standard highways, that should allow the passage of vehicles carrying international standard containers in view of establishing an efficient distribution network. In practical terms, the network comprises three elements: trunk roads including high standard highways, national roads,

and ring roads, access routes from trunk roads to ports, etc., and access routes from trunk roads to distribution centres.

To conclude,

there are some promising approaches of how to cope with the existing and upcoming traffic demand of growing trade relations around the globe by building trans-national networks and inland distribution networks, e.g. Europe and Japan. But mostly the realisation of these projects has just started and will challenge the communities for the next 10-15 years.

3.3. Future challenges for an ongoing sustainable development

It had been shown that the planning of priority transportation corridors is an approach to deal with the development increasing trade relations within and between major economic regions. Nevertheless, there is a need to highlight some open issues necessary to be addressed in the future more deeply. These are:

Balancing development between high priority networks and hinterland regions

The concentration – especially of investments – on a major strategic network and priority corridors with a main focus on international connections holds the risk that rural, secluded regions will not be developed in an efficient way.

The construction ratio of National expressways in **Japan** is over 70%, achieving a certain level of success, but there is a large gap between cities and rural areas. In rural regions over 90% of the movement of people depends on automobiles, but despite this fact, in regions like Hokkaido and Shikoku that are far from major cities, there are still places that cannot be reached by expressways within 90 minutes, and the minimum infrastructure has not been constructed.

Slovenia reports that the Pan-European infrastructure networks bring most benefits to major centres located along the corridors, which enable them a favourable connection with other major centres. Contrary to this, smaller centres in the hinterland, which are not connected with the corridors, may get into an even worse competitive situation.

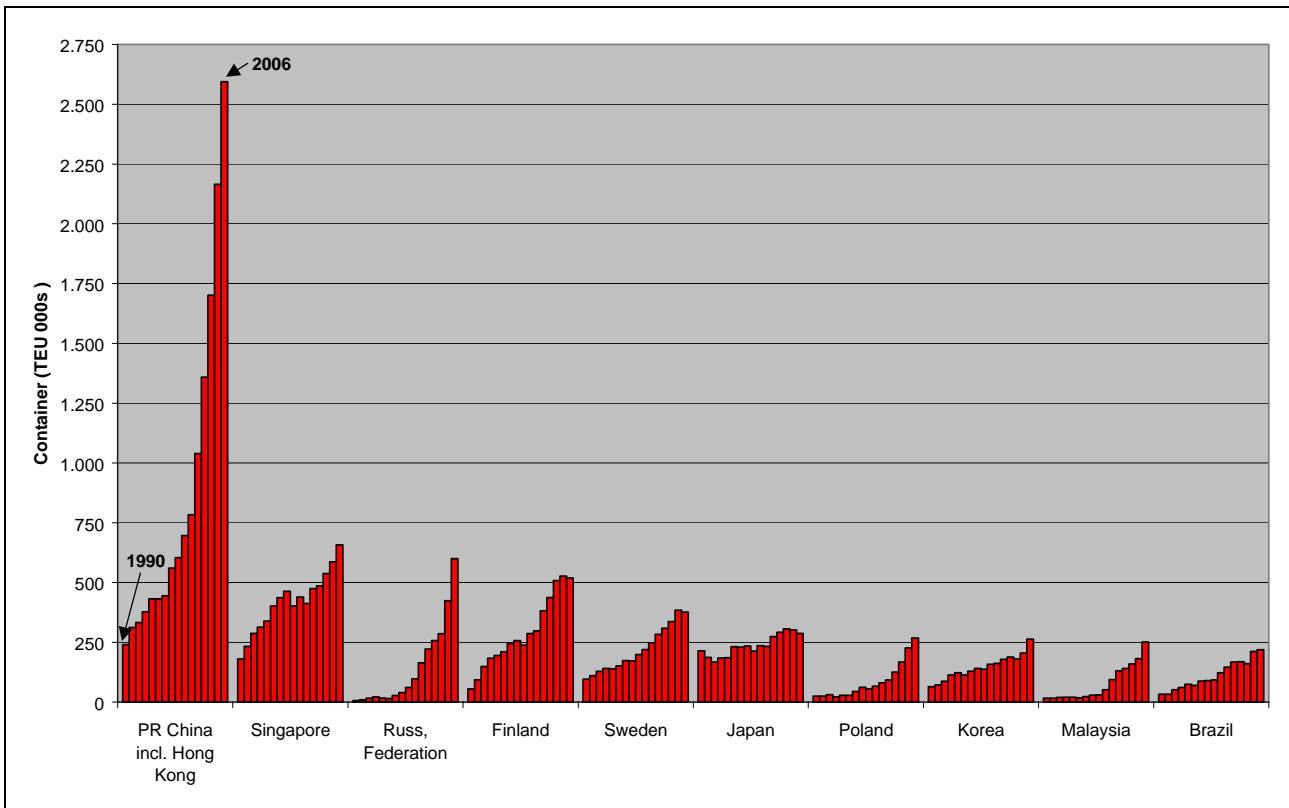
This means that there must be a discussion of how to balance the rate of development between high priority networks and regions in the hinterland, in the future.

Upgrading local distribution networks

Taking into consideration the delivery of goods from local economic regions to the trans-national corridors a local strategic distribution network needs to be established as well. There is a potential risk that transit connections are in the main focus but bottlenecks in the secondary road network will cut off regions from economic growth.

There must be an awareness that global transport chains have impacts on local infrastructure, too. One example of these interdependencies is the Port of Hamburg in Germany:

The analysis of the market conditions and the prognosis of the current turn-around of goods underline the long-term potentials of the Port of Hamburg.



Main Trading Partners of the Port of Hamburg - Seaborne Container Traffic
 (Data source: <http://www.hafen-hamburg.de/images/daten/top-trad-p.xls>)

The harbour acts as:

- ☑ a north European traffic nod with optimal sea and land connections to the European hinterland offering a broad variety of services,
- ☑ an European centre for the Asia trade, and
- ☑ a prospering location for logistic services and port-related industry.

The Port of Hamburg ranks among the most productive hubs of the world which is also caused by its structure and the division of responsibilities between state and private sector. Since 1970 the state is only responsible for the infrastructure, private enterprises for the operation. There are approximately 200 market-focused enterprises co-operating in the transport chain in competition.

For the economical success of the Port of Hamburg a competitive development of the access roads and of efficient hinterland connections are of crucial importance. This has been regarded when doing the priority list of the German development plan (BVWP) considering land, rail and water transport links.

Strengthening of nodes within a strategic transportation network

In view of strategic corridors and priority networks the nodes of that network are of particular importance. There is a potential risk after an upgrade of the links that the nodes turn out to be the bottlenecks. Therefore the design of high-capacity distribution nodes need to be a major part of the planning process in the future.

Tackling upcoming demand in developing countries

Developing countries are likely to make a major progress in terms of economic growth and trade relations in the future. The idea of a comprehensive transportation plan that integrates all modes of transport and therefore takes advantage of the more balancing accommodation of the transport demands should be discussed with developing countries.

With regard of foreign trade there had been a notably change in the type of products exported by developing countries. The consequences of this change needs to be considered as well.

Making networks reliable in operation

It will be an ambitious task to build up the planned networks that carry the load of traffic but to keep these networks capable in operation is an equally important task. The reliable forecast of arrival times is extremely important for commercial transport. In industrial countries this primary means to cope with delay times due to congestion, in developing countries this could mean to assure access to the road in all seasons.

Financing the measures

The realisation of the measures discussed for an adequate reaction on globalisation will require investments. Although there is a special Working Group dealing with the issue of financing in more detail, the need for solutions on how to finance these new approaches should be mentioned in the context of sustainability as well.

In the past 50 years **Japanese** National expressways have been constructed by borrowing money, and these funds have been repaid through tolls. There will be a change in concept as future construction of roads would mainly be undertaken in regional areas with less traffic. This new development was considered impossible to maintain profitability. Two schemes will be applied for the construction of national highways in the future: the toll road system as the Japan Highway Public Corporation had been utilising in the past and direct control system by the national and local governments utilising fund made available from taxes for furthering construction.

In **Hungary**, the basic principle in the case of investments into intermodal logistics is that the State shall participate in ensuring basic conditions of operation, which can not be realised by private actors – due to efficiency, technology, and other factors –, although these are essential from the point of view of high-quality and less environment-damaging transport logistics services. So, the state supports or contributes to the establishment or improvement of further logistics facilities.

4. CONSEQUENCES OF THE DEMOGRAPHIC PROCESS ON ROAD INFRASTRUCTURE

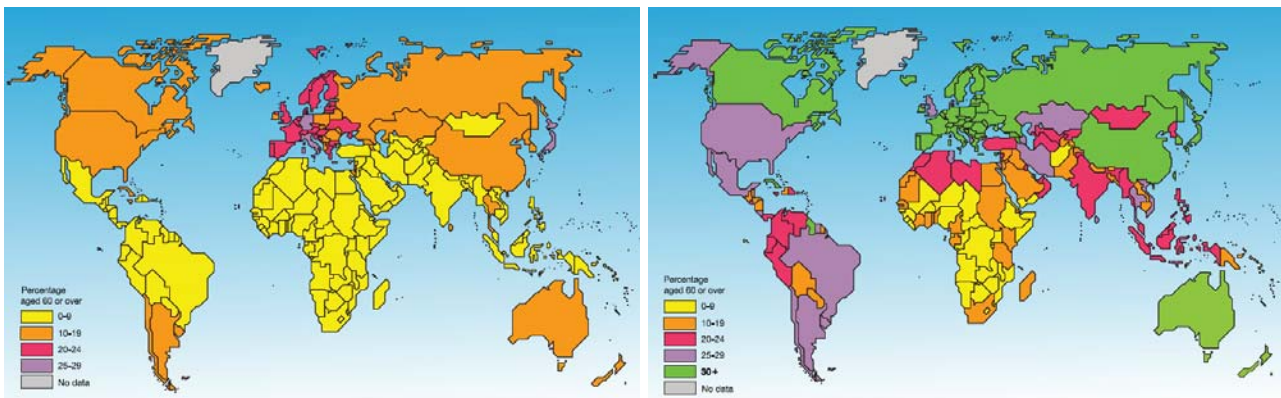
4.1. Expected demographic changes around the world

When discussing the aspect of demographic changes there are three major parameters to consider:

- ☑ the declining and increasing population in different regions
- ☑ the different ageing structures and
- ☑ increasing migration streams.

According to the press release POP/952 of the United Nations from March 13, 2007 about the 2006 Revision of the official United Nations population estimates and projections, the world population will likely increase by 2.5 billion over the next 43 years, passing from the current 6.7 billion to 9.2 billion in 2050. This increase is equivalent to the total size of the world population in 1950, and it will be absorbed mostly by the less developed regions, whose population is projected to rise from 5.4 billion in 2007 to 7.9 billion in 2050.

As a result of declining fertility and increasing longevity, the populations of more and more countries are ageing rapidly. Between 2005 and 2050, half of the increase in the world population will be accounted for by a rise in the population aged 60 years or over, whereas the number of children (persons under age 15) will decline slightly. Furthermore, in the more developed regions, the population aged 60 or over is expected to nearly double (from 245 million in 2005 to 406 million in 2050), whereas that of persons under age 60 will likely decline (from 971 million in 2005 to 839 million in 2050).



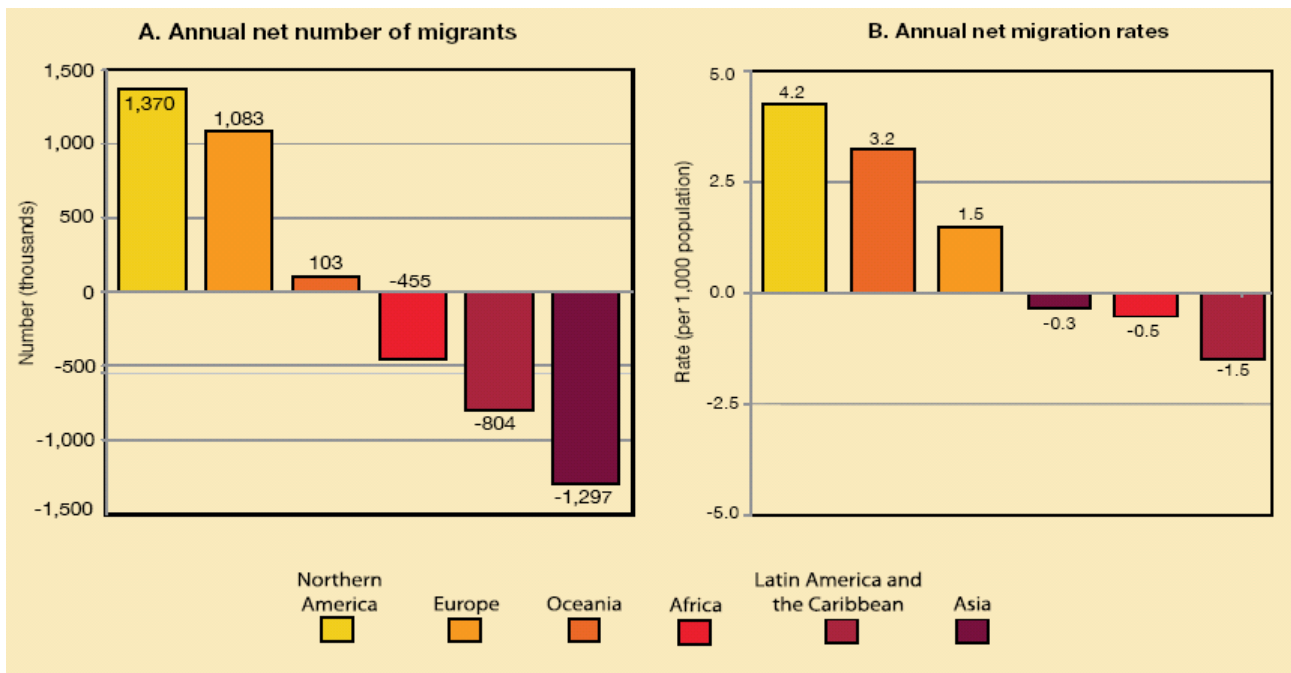
Percentage of total population aged 60 years or over in 2006 (left) and 2050 (right) (see Population Ageing 2006, United Nations)

In many states of the world demographic changes emerge which will have influence on the transport infrastructure. Some of the industrial countries, like Germany, Japan and Quebec report a need to cope with the structural changes in the society.

Germany's population structure – for example – is likely to start changing dramatically in the year 2020. These changes will be characterised by noticeable drops in population and shifts in the population's age structure (ageing). This will result in considerable disparities

in the development of regions, sub-regions, and urban districts. In short, Germany will be faced with very different levels of growth and shrinkage.

The population of the more developed regions is expected to remain largely unchanged at 1.2 billion and would have declined, were it not for the projected net migration from developing to developed countries, which is expected to average 2.3 million persons annually.



International migration flows and migration rates in the world's major areas, 2000-2005 (see International Migration 2006, United Nations)

To conclude,

all regions of the world are faced with major demographic changes although there will be differences. There will be high birth-rates in developing countries that go along with high rates of migration. On the other hand, population in industrial region is likely to shrink and average age will be rising – if there weren't emigrants. But it must be noted that a reliable prognosis of the demographic changes can only be done in short and medium term. Long term trends (50 years and more into the future) can only be estimates based on assumed scenarios. A sustainable transportation planning must consider these developments.

4.2. The demographic demands on road infrastructure

Although the demographic changes are discussed for some years there are still a lot of open questions about the impacts on transport and road infrastructure.

The need to monitor and analyse specific mobility indicators

In view of demographic developments, specific mobility indicators and the factors that determine them are used to estimate future mobility demand and long-term requirements regarding the provision of transport services. A knowledge of the reasons that determine how mobility decisions are made in everyday traffic situations is also vital if transport modes are to be intelligently linked.

Therefore, there is a need to carry out mobility surveys. The information provided by these surveys should be used by the transport sector in many different ways. Experts agree that in view of demographic changes, the use of 'lifecycle observations' to monitor transport trends, traffic forecasts, and effective and efficient infrastructure planning is essential if solutions that bring economic benefits, are socially acceptable, and respect the environment are to be developed.

In industrial countries there is still a need to analyse how mobility indicators (such as "kilometres travelled per person and day") will change in the future. Will elderly transport participants of the future have the same daily rate of trips as today when they travel less than younger generations? Would that lead to a decrease of traffic demand when the population is ageing? The answers to these questions are essential for a reliable estimation of the changes in traffic demand, modal split, temporal distribution of traffic.

The need for elderly-friendly planning

In view of demographic developments, the road research sector in industrial countries is currently paying particular attention to the needs of elderly people in road traffic. In this context, new tools and measures are being developed to ensure that the specific requirements of elderly people will be better taken into account in future.

On the basis of these analyses, suitable measures for ensuring mobility and improving objective and subjective road safety levels for elderly people would subsequently be selected and prioritised. Generally speaking, 'elderly-friendly planning' is based on the 'two senses principle': Facilities must address users by means of at least two senses, e.g. tactile elements or optically contrasting elements. In view of the fact that high concentrations of accidents involving elderly people mainly occur at facilities with complicated designs, one of the tasks of the future will be to simplify traffic flows.

The need to analyse the safety impact of an ageing population

One consequence that immediately comes to mind in terms of associating an ageing population with transportation issues is the risk of having much more elderly drivers on our roads in the relatively near future. According to studies that were conducted by the Société de l'assurance automobile du Québec (SAAQ), very old drivers (aged 75 and over) are more accident prone than the average, but are far less accident prone than the youngest age group. Although they perform better than drivers between the ages of 16 and 19, their score is worse than that of 20-to-24-year-olds only in terms of fatal accidents per 100 million kilometres driven. However, knowing that limiting travel is one of the main strategies

that older drivers employ in adapting to diminished abilities, one can consider this additional hazard to be an essentially theoretical risk. Therefore, the risks associated with limitations due to age are not as great as those associated with youth and inexperience.

There is more research needed in order to quantify the effects of an ageing population on road safety.

5. IMPACT OF ROADS ON QUALITY OF LIFE

With view on the impact of roads on quality of life economic and financial, environmental and ecological as well as social aspects are to be considered. The ST2 Session at the XXIIInd World Road Congress in Durban in 2003 had its focus on "Roads and quality of life" and already gave a broad overview of important topics to discuss in that context, from measures to cope with congestion in urban areas and to improve public transport up to methods to assess impact of roads, eg. noise. The Technical Committees have adopted the arguments and report on that in their sessions in detail.

The "Climate Change" has reached a new quality in the public awareness all over the world. The issue of CO₂ reduction is already a major aspect of an environmental sustainability. The road transport needs to contribute to that goal. Therefore the following paragraphs concentrate on the issue of CO₂ reduction as it will be one of the major challenges in the future.

World's energy demand and its consequences

The world's energy demand will dramatically increase in the coming decades. According to forecasts of the World Energy Council an average global growth rate of 1.8 percent annually is expected for the energy demand until the year 2030. The increase in energy demand during this period has to be covered, despite the growing shares of regenerative energies, to a decisive degree by fossil energy sources. The increase of the CO₂ emissions and of other environmental burdens, but mainly the growing scarcity of fossil energy carriers, make the search for alternatives in energy supply indispensable.

The signs for the climatic change are accumulating up. The past decade was the warmest since the regular measurement in 19th Century. And it was characterised by an increase of extreme climatic phenomena. Thus the carbon dioxide output has contributed to a global temperature rise of 0,8 degrees between 1860 and 2000 (Intergovernmental Panel on Climate Change, IPCC). According to the IPCC report the heating up will happen between the year 2000 and the year 2100 between 1,4 and 5,8 degrees.

On the basis of economic model calculations of variant researchers the costs and risks of the climatic change, if nothing is undertaken against it, could equal a loss of at least 5% global GDP annually now and in the future. On the other hand it would be possible to limit the annual costs of the procedure, i.e. a reduction of the greenhouse gas emissions, for the prevention of the worst consequences of the climatic change to approx. 1% for global GDP. Therefore an immediate and decided procedure is demanded. Since the climatic change is a global problem, also the reaction to it must be international. It presupposes a consent over the long-term goals and requires the agreement of frame systems for a faster procedure in the next ten years, constructing on concepts on national, regional and international level, which strengthen mutually. The developed countries have the task to take a trend setter role. They have to take over the responsibility for an absolute lowering of the emissions (experts are speaking about 60-80% to 2050), and the have to co-operate with the developing countries to master this enormous challenge. The "rich world" must seize measures to a considerable extent also for the developing countries.

The common challenge to face now therefore is to lay the foundations for a sustainable energy supply.

CO2 reduction and transport

Although the traffic of passenger cars accounts for about 11% of CO2 emissions in the European Union and globally 5%, also the transport has to make its contributions for the avoidance from greenhouse gases. In the year 2020 there will be 1.5 billion vehicles worldwide. The largest growth rates are expected in the fast growing states in far east.

Measures of avoidance will be different:

Japan hopes to achieve the annual target of 8 million tons on CO2 reduction in 2010 by implementing Comprehensive Transportation Strategies. Up until now, Japan has proposed countermeasures for traffic congestion in terms of capacity and demand in urban areas, but in the future it will be necessary to establish integrated plans in view of achieving sustainable transport. It is needed to conduct more comprehensive studies of the urban transport system to formulate specific strategies for sustainable transportation. For instance, city scale, structure, and its characteristics should be taken into consideration, and basic policies for sharing tasks between public transportation and automobile traffic should be drawn. Also the areas to enhance the convenience of automobile traffic and areas where automobile traffic must be controlled should be marked off. For this purpose, Japan will establish the Urban and Regional Comprehensive Transportation Strategy Conference in fiscal year 2007, made up of representatives from road management, city planning and public safety commission members who have participated in the past, and representatives from the public transportation organisations, to propose and implement radical countermeasures for urban mobility.

The **European Union** are prepared to lower the green-house gas emissions in the period until 2012 alone by 8 percent compared to the situation in 1990. The key to an effective protection against climate change and at the same time to a successful economic development is a sustainable energy supply. Only an efficient use of all energy sources and at the same time the development of the regenerative energies will make it possible to start out on the path to a reasonable energy future.

Promising action fields in the task of CO2 reduction

In the task of CO2 reduction the following action fields can be discussed:

promotion of regional economical circulation with, like

- traffic-avoiding structures of settlement
- traffic-avoiding structures of production

promotion of environmental friendly modes of transport, like

- efficient public transport
- telematics
- bicycle and pedestrian traffic
- car sharing

monetary measures, like

- taxes on the air traffic
- taxes for heavy traffic on motor- and highways
- "eco-tax"
- CO2-oriented vehicle-tax
- reduction of vehicle tax privileges for cars
- tax-adjustment of fuel and gasoline
- CO2-trade in the field of transport

technical optimizations

- reduction of consumption
- Updating of the self obligation
- CO2-limits
- alternative fuels and drives

consumer behavior

- information promotion of gasoline saving driving
- speed limits

Also the operation and management of roads can make a substantial contribution to the CO₂ decrease. The following potential measures concentrate on the avoidance of congestion by:

- removal of bottlenecks
- building of by-passes around urban areas
- development of new telematic techniques
- management of building sites
- preservation and maintenance measures.

Existing structures for a close-range mobility combined with an attractive public transport system and urban compatible cars running with alternative fuels can help to develop CO₂-reduced transport structures for a future oriented sustainable development.

To conclude,

the mitigation of the impacts of roads on quality of life will challenge also for the next years. Especially measures to cope with the world's energy demand and its consequences need to be in the focus. The contribution of the transport and road sector to the reduction of CO₂ needs further research and discussion.

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DRAFT CONCLUSIONS

Although many countries of this world have already included the goal of sustainability into their planning, construction and operation of roads today, there are many requirements still to be tackled on the route to an environmentally respectful and socially just development.

Especially the idea of a comprehensive intermodal approach for a strategic transport planning should be followed up with and introduced especially to the developing countries.

Road transport is definitely one of the major transport modes but it can be said today that a sustainable development does not only start with the question of how to make road transport sustainable. This means that the different transport modes should not be dealt with separately in the strategic planning process. The identification of transport needs and the definition of transport corridors to fulfil these needs are a first step of a sustainable transport planning. Within those identified corridors different transport modes can carry the load of traffic. The distribution of the demand on the different modes in a corridor is one of the challenges of sustainable planning. Furthermore, the experience of bundling different modes in a corridor has shown some good effects to mitigate the negative impacts of traffic in a whole such as e.g. noise pollution.

Transport chains and corridors in a world of globalisation

The establishment of economic treaties and trade agreements all over the world have major impacts on the foreign goods trade – already today and even more in the future. These developments give clear evidence of the increasing importance of the interregional and international transport networks to economic development. There is an eminent need of all countries to work together.

It had been shown that the planning of priority transportation corridors is an approach to deal with the development increasing trade relations within and between major economic regions.

Nevertheless, there is a need to highlight some open issues necessary to be addressed in the future more deeply. These are:

- ☑ Balancing development between high priority networks and hinterland regions
- ☑ Upgrading local distribution networks
- ☑ Strengthening of nodes within a strategic transportation network
- ☑ Tackling upcoming demand in developing countries
- ☑ Making networks reliable in operation
- ☑ Financing these measures

It can be noted that countries that are just about to enter global market attach more importance to a fast upgrading of their road networks in order to cope with traffic demand while industrial countries make a greater effort with tackling congestion on the existing networks within the limits of social and environmental requirements.

Consequences of the demographic process on road infrastructure

All regions of the world are facing major demographic changes although there will be differences in development. There will be high birth-rates in developing countries that go along with high rates of migration. On the other hand, population in industrial region is likely to shrink and average age will be rising – if there weren't migration. But it must be noted that a reliable prognosis of the demographic changes can only be done in short and medium term. Long term trends (50 years and more into the future) can only be estimates based on assumed scenarios. A sustainable transportation planning must consider these developments by e.g.:

- ☑ monitor and analyse specific mobility indicators
- ☑ include elderly-friendly aspects into planning process
- ☑ analyse the safety impact of an ageing population

Impact of roads on quality of life

The mitigation of the impacts of roads on quality of life will challenge also for the next years. Especially measures to cope with the world's energy demand and its consequences need to be in the focus in future.

Many countries have already set a target on the reduction of CO₂ by implementing comprehensive transportation strategies. Technical, organisational and monetary measures are discussed as contributions of the transport and road sector to that goal.