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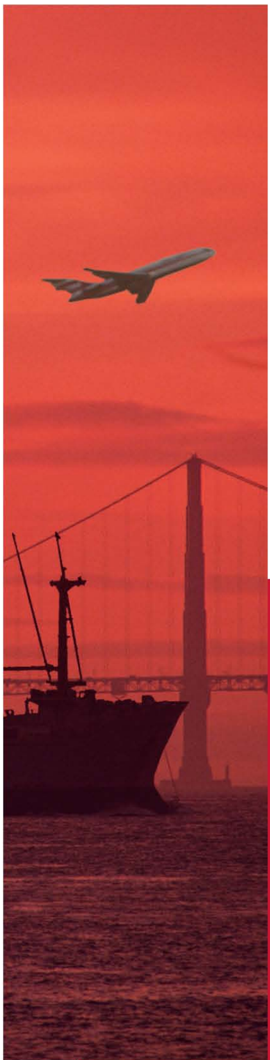
POLICY DEPARTMENT B
STRUCTURAL AND COHESION POLICIES



Agriculture and Rural Development

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THE FUTURE OF THE EU'S TRANSPORT INFRASTRUCTURE

NOTE

EN

2010

EUROPEAN PARLIAMENT

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES

TRANSPORT AND TOURISM

WORKSHOP
'THE FUTURE OF TRANSPORT'

THE FUTURE OF THE EU'S TRANSPORT INFRASTRUCTURE

NOTE

This document was requested by the European Parliament's Committee on Transport and Tourism.

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TRANSPORT AND TOURISM

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THE FUTURE OF THE EU'S TRANSPORT INFRASTRUCTURE

NOTE

Abstract

This note covers issues that were presented and discussed at a workshop on 'The Future of Transport' held in the European Parliament on 2 December 2009.

The briefing note takes into consideration the role of transport infrastructure in EU policy consolidation in order to achieve the EU's overall sustainable development objectives: the EU's economic competitiveness, territorial cohesion, good governance and well-being of society. The vision of the EU's future transport infrastructure is based on four development scenarios. A set of features of transport infrastructure at the 2050 horizon and the risks inherent in the nature of major transport infrastructure projects are discussed.

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CONTENTS

LIST OF ABBREVIATIONS

BRT	Bus Rapid Transit
ETP	European Transport Policy
GDP	Gross Domestic Product
HRS	High Speed Railway
ICT	Information and Communication Technology
ITS	Intelligent Transport Systems
LRT	Light Rail Transit
TI	Transport Infrastructure
NMS or EU-12	New Member States
EU-27	All EU Member States
EU-10	New Member States without Bulgaria and Romania
ETS	Emission Trading Scheme

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EXECUTIVE SUMMARY

Background

The transport infrastructure (TI) projects have 'mega-project' characteristics in most cases. General characteristics of the TI mega-project (according to Bruijn & Leijten, 2008) are as follows:

- Colossal in size and scope: TI covers large physical space; transport investment has an important political role: in the short term, on one hand, TI investment may lead to an economic multiplicative effect, as long as TI investment is included in a comprehensive planning frame; on the other hand, in the long term, large TI investment has structural effects on the entire economic-social-environment space;
- Captivating because of size, engineering achievements and aesthetic design: investments in TI take a long time to be carried out: the construction of a major facility may take from 5 to 15 years from planning to full implementation;
- Costly: TI's costs are often underestimated; moreover, for most of the transport modes, TI cannot be partially provided: the complete benefit is achieved only in the event of TI's completion;
- Controversial: by funding, mitigation packages, impacts on third parties; the separation between the supplier of TI and provider of the final transport services generates a rather complex set of interactions among government authorities, construction companies, developers, transport operators, travellers and shippers, car users, residents, etc. (Raicu, 2008).
- Complex in terms of the risk and uncertainty of design, funding and construction;
- Control issues: who are the key decision-makers regarding funding, operation, etc.

An accurate prediction for TI's long-term development is a difficult task, because of the above characteristics.

Aim

This note covers issues that were presented and discussed at a workshop on 'The Future of Transport' held in the European Parliament on 2 December 2009.

Method

The briefing note discusses the answers to the following questions:

1. Relating to EU policy:

- What are the main objectives of EU policies relating to the transport sector?
- How are these objectives reflected in EU policy documents (especially the communication 'A Sustainable Future for Transport: towards an integrated technology-led and user-friendly system', hereinafter referred to as 'the communication')?
- What are the most relevant strengths and weaknesses of the communication (to be considered in a long-term TI vision)?

2. Relating to the actual evolution of the TI:

- What are the TI's recent trends and problems at three different levels (EU, regional, local/urban)?
- What are the specific problems affecting TI development in the NMS?

3. Relating to the EU's future transport infrastructure:

- What research is available on the long-term development scenarios for the transport sector, in terms of TI development?
- Can we describe the main TI features at the 2050 horizon according to the development scenarios?
- What makes the significant difference between the most desirable scenarios?
- What is the nature of the risks in TI project completion? Is it possible to cope with the risks in TI projects?

The briefing note is structured as follows: the first section focuses on the strengths and weakness of the communication in relation to TI development; in the second section the current trends and problems of TI development are discussed; the third section addresses the future of the EU's transport infrastructure; various conclusions are drawn in the final section.

1. STRENGTHS AND WEAKNESSES OF THE COMMUNICATION ’A SUSTAINABLE FUTURE FOR TRANSPORT’

The European Commission communication ‘A Sustainable Future for Transport: Towards an integrated, technology-led and user-friendly system’ is a concise guideline for the most important stakeholders in transportation at different levels: EU level, Member State level and local/urban level (EC, 2009).

The communication is a comprehensive document synthesising the policies, instruments and guiding methods in order to translate the defined vision for the transport future into effective policy actions.

The communication is even more valuable, from a strategic point of view, if we consider the tremendous unpredictability related to: global macroeconomic dynamics; socio-cultural and behavioural changes; scientific discoveries and their rapid technological implementation.

In a concentrated section about the first decade of the 21st century, the communication provides a brief list of the most relevant achievements in the transport sector, most of them related to economic objectives. The same section also fairly considers the limited results in relation to the goals of the sustainable development strategy in the EU transport sector.

The communication gives a justified central position to ‘Infrastructure: maintenance, development and integration of modal networks’, because it is included among the other six implementation actions of ETP.

Also, the communication deals, as a political tool, with the question of how to find the financial resources for a sustainable transport system and stresses the necessity of applying the ‘user-pays’ principle as a source for the TI’s financing.

The communication states that one of the most important instruments for speeding up the transition to a ‘low-carbon society’ lies in standard and norm setting for infrastructure, vehicles and operational technologies, including ICT & ITS. Setting standards and norms for improved interoperatibility in the transport sector actually means that the European Commission will assume more responsibility in the future.

The progress and actual achievements of the European Transport Policy (ETP) would have been highlighted to a greater extent if the objectives of the current White Paper had been presented too.

Some paragraphs are dedicated to GHG emissions, although not in a comprehensive way, in order to point out the most responsible mode of transport.

The communication mentions ICT and ITS even in its subtitle (i.e. ‘Towards an integrated, technology-led and user-friendly system’). Contrary to expectations, the document does not include any appraisal of the positive effects of ICT & ITS on transport problems: road congestion, vehicle fleet management, passenger information in-terminal and in-vehicle, efficient logistic chains, transport demand management, etc. (Curry et al., 2006). Such an evaluation would have been useful to justify and to stress, even in a formal manner, the important ‘technology-led’ aspect for the EU's transport future.

The progress in-time of TEN-T network implementation by modes should be stressed. There has been capital inertia, which means that the involved funds allotted to TI are blocked. This fact has to be taken into account in the planning of future actions.

The communication presents the objectives in relation to the three major strategic directions of Europe's sustainable development:

- the first strategic direction: **Europe's competitiveness** in the face of world **economic, energy and environment challenges** in relation to the USA, Japan and Asia (China and India), e.g. objectives 2 and 4 in Section 4 of the communication (Schade et al., 2006),

- the second strategic direction: **intra-European competitiveness**, **cohesion and integration**, e.g. objectives 1 and 6 in the above-mentioned communication,

- the third strategic direction: **the environment-friendly, life-sustaining urban/local space**, e.g. objective 7 in the same document.

2. RECENT TRENDS AND PROBLEMS CONCERNING THE EU'S TRANSPORT INFRASTRUCTURE

It has been more than 15 years since the first 14 priority projects were identified by the 1994 Essen European Council and then included in the 1st Decision of the European Parliament and of the Council on Community guidelines for the development of the TEN-T, in 1996. The priority projects list was extended in 2004 to take account of the accession of 10 and then 2 more New Member States to the EU. The TEN-T network now comprises 30 priority projects which should be completed by 2020.

The sustainable use of resources is an essential aspect of policy on the TEN-T and the priority projects give privileged status to those modes which are more environment-friendly. Of these 30 priority projects, 18 are railway projects, 3 are mixed rail-road projects, 2 are inland waterways transport projects and 1 refers to motorways of the sea. The proposed project selection in the field of priority projects contributes to the Commission's objective in terms of sustainable development. Three quarters (74.2%) of the funding goes to railway projects and another 11.5% is reserved for inland waterways. The support for road and air transport is more limited.

The very new grants, totalling around EUR 500 million, will go towards projects in Austria, Belgium, Germany, Spain, France, Hungary, Italy, Netherlands, Portugal, Sweden and the UK. The capital will be allocated under the TEN-T Programme and constitutes a part of the Commission's response to the economic crisis (EC, 2009).

Implementation of the trans-European transport networks requires substantial amounts of funding. Based on the revised information from the Member States, the overall cost of the network is EUR 900 billion and nearly EUR 500 billion still need to be invested to 2020. Completion of the priority projects alone requires more than EUR 250 billion by 2020.

The TEN-T projects as well as other TI projects at national level are large-scale projects. Some of the TEN-T projects have already been completed; others will be completed soon. However, the completion dates for some of the other major projects have fallen behind the original timetables (ANNEX 1), and significant parts of the 30 priority projects will not be realised until 2010, 2015 or even 2020.

The reasons why some projects are lagging behind schedule are as follows: the enormous complexity of these key projects, sometimes a lack of financing and/or financial guarantees, often a lack of coordination, project preparation and planning, and regulatory constraints.

An average time per completed km is a useful indicator to reveal the long duration for the accomplishment of High Speed Rail (HSR) and motorway projects. The figures in Table 1 and Table 2 reveal the difficult in-time progress of HSR and motorways respectively.

Table 1: HSR's work speed

	Length of HSR* km (at end of year)							km per year
	BE	DE	ES	FR	IT	UK	EU	
1985	-	-	-	417	224	-	641	-
1990	-	90	-	699	224	-	1 013	74.4
1995	-	447	471	1 220	248	-	2 386	274.6
2000	58	636	471	1 278	248	-	2 691	61
2001	58	636	471	1 573	248	-	2 986	295
2002	120	833	471	1 573	248	-	3 245	259
2003	120	875	1 069	1 573	248	74	3 959	714
2004	120	1 202	1 069	1 573	248	74	4 286	327
2005	120	1 202	1 090	1 573	468	74	4 527	241
2006	120	1 291	1 272	1 573	562	74	4 892	365
2007	120	1 300	1 516	1 893	562	113	5 504	612
2008	120	1 300	1 594	1 893	744	113	5 764	260
23 years							5 123	*222*

*Length of lines or of sections of lines on which trains can go faster than 250km/h at some point during the journey

Source: EU energy and transport in figures. Statistical pocketbook 2009

Table 2: Motorways' work speed

	km (at end of year)							Average length per year	Area, 1000 sq.km	Yearly length/ Area, km/ 1 mill. sq.km
	1990	1995	2000	2003	2004	2005	2006			
EU-27	41885	47970	54700	58850	60100	62000	63400	1345	4,323.0	311.05
km per year	-	*1217*	*1346*	*1383*	*1250*	*1900*	*1400*			
EU-15	39616	45468	51471	55292	56294	58000	59205	1224	3,236.3	378.31
km per year	-	*1170*	*1201*	*1274*	*1002*	*1706*	*1205*			
EU-12	2269	2502	3229	3558	3806	4000	4195	120	1,086.7	110.77
km per year	-	*47*	*145*	*110*	*248*	*194*	*195*			

Source: EU energy and transport in figures. Statistical pocketbook 2009

The motorway's work speed has a better value in the EU-15 than the EU-27, which indicates high interest in motorway building in the EU-15.

The EU cohesion goal has not been achieved yet: let us look at the completed TEN-T projects map in ANNEX 2 (EC, 2008). At the same time, let us consider the poor condition of the ordinary terrestrial networks (road and rail) in some of the NMS (e.g. Bulgaria and Romania).

Romania is participating in three priority projects: PP7, PP18 and PP22, for which it is the beneficiary of 18.9% (EUR 3 622 million between 2007 and 2013) of the total cohesion and structural funds totalling around EUR 19 213 million.

The terrestrial networks of Bulgaria and Romania are in poor condition. Table 3 shows the rail length evolution in the EU-27, with a particular focus on Bulgaria and Romania. Only the EU-15 rail networks plus HSR have a good position in terms of density. A simple comparison, considering the total length of the electrified, on one hand, and total railways, on the other hand, reveals that:

- Romania has only 16.75 km of electrified railways per 1 000 sq. km of territory, and Bulgaria has a value close to the average value of the EU-27 and even the EU-15; (Luxembourg and Belgium have the highest value - about 100 km per 1 000 sq. km).
- By contrast, Romania has an average value of 45.38 km of total railways per 1 000 sq. km that is close to the average value of the EU-15, and Bulgaria has only 37.36 km per 1 000 sq. km (the Czech Republic has the highest value - about 120 km per 1 000 sq. km).

Table 3: Railway length evolution

	Km						km of which electrified 2007		Area, 1 000 sq.km	Popula-tion in millions at 1/1/2008	Total length/area, km/1 000 sq.km	Elect.length/area, km/1 000 sq.km	Electrified length / population, km/1mill. citizens
	1990	1995	2000	2005	2006	2007	2007	%					
EU-27	231 582	227 105	217 349	215 542	215 856	212 336	109 564	51.6	4 323	495 578	49.12	25.34	221.08
EU-15	162 132	160 000	151 938	153 515	154 087	150 763	82 505	54.7	3 236	392 262	46.58	25.49	210.33
EU-12	69 450	67 105	65 411	62 027	61 769	61 573	27 059	43.9	1 087	103 316	56.66	24.90	261.91
EU-10	53 803	51 435	50 076	46 925	46 842	46 653	20 274	43.5	738	81 776	63.19	27.46	247.92
BG	4 299	4 294	4 320	4 154	4 146	4 143	2 806	67.7	111	7 640	37.36	25.30	367.28
RO	11 348	11 376	11 015	10 948	10 781	10 777	3 979	36.9	238	21 529	45.38	*16.75*	184.82
HSR	1 013	2 386	2 691	4 527	4 892	5 504	5 504	100	3 236	392 262	1.70	1.70	14.03

Source: EU energy and transport in figures. Statistical pocketbook 2009

The HSR in the EU-15 improves the average density of the total railway network in those countries, but average density for the HSR for the entire territory of EU-15 is low, having about 2 km per 1 000 sq. km (an additional study relating to HSR coverage is required in order to provide a comprehensive analysis).

Table 4 shows the evolution of the motorways length in Europe and also in Bulgaria and Romania and Table 5 shows the road density, considering all type of paved and unpaved roads.

Table 4: Motorway length evolution

	km (at end of year)							Area, 1 000 sq.km	Length / area, km/1 000sq.km	Population, million at 1/1/2008	Length / population, km/ 1 mill. citizens
	1990	1995	2000	2003	2004	2005	2006				
EU-27	41 885	47 970	54 700	58 850	60 100	62 000	63 400	4 323.00	14.67	495.578	127.9
EU-15	39 616	45 468	51 471	55 292	56 294	58 000	59 205	3 236.30	18.29	392.262	150.9
EU-12	2 269	2 502	3 229	3 558	3 806	4 000	4 195	1 086.70	3.86	103.316	40.6
EU-10	1 883	2 112	2 797	3 117	3 247	3 441	3 573	738.30	4.84	81.787	43.7
BG	273	277	319	328	331	331	394	110.90	3.55	7.640	51.6
RO	113	113	113	113	228	228	228	237.50	0.96	21.529	10.6

Source: EU energy and transport in figures. Statistical pocketbook 2009

Table 5: Road density

	Motor-ways	National roads	Regional roads	Other roads (*)	Total length, km	Area, 1 000 sq.km	Length/ area, km/1 000 sq.km	Population, million at 1/1/2008	Length/population, km/1 mill. citizens
EU-27	63 400	266 733	1 407 257	2 894 231	4 631 621	4 323.00	1 071	495.578	9 346
EU-15	59 205	209 683	1 168 205	2 272 235	3 709 328	3 236.30	1 146	392.262	9 456
EU-12	4 195	57 050	239 052	621 996	922 293	1 086.70	849	103.316	8 927
EU-10	3 573	38 326	171 062	610 007	822 968	738.30	1 115	81.787	10 062
BG	394	2 969	4 021	11 989	19 373	110.90	*175*	7.640	2 536
RO	228	15 755	63 969	0	79 952	237.50	337	21.529	3 714

*- The definition of road types varies from country to country; the data are therefore not comparable; 'Other roads' sometimes includes roads without a hard surface

Source: EU energy and transport in figures. Statistical pocketbook 2009

Bulgaria has built slowly about 121 km of motorway since 1990 (2006 reference); Romania, in 2006, had only 115 km of new motorway, which was in fact an upgraded part of a national road linking Bucharest and the Black Sea region.

The average density of the motorways in the EU-15 is about 19 times higher than the motorway density in Romania and only 5 times higher than the motorway density in Bulgaria.

Considering the motorway density in terms of population, the situation in Romania is even worse: 1 million Romanian citizens have 14 times less motorway than 1 million EU-15 citizens. In contrast, 1 million Bulgarians have only 3 times less length of motorway than EU-15 citizens. Because of its smaller population Bulgaria has an average value of the motorway density which is greater than that of the EU-10 (51.6 km per 1 million citizens).

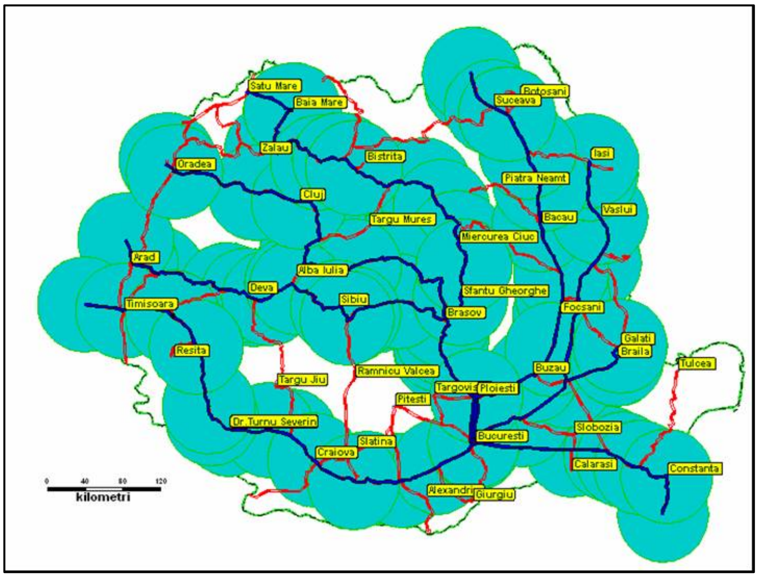
However, comparing the EU-15 and EU-10, the average value of the motorway density of the latter is lower than the average value for the first group of countries, whatever reference we take (area or population).

The average value of the network density (including paved and unpaved roads) in EU-15 countries has almost the same value as the EU-10, considering the area of territory. The values of Romania and Bulgaria downgrade the average value of the EU-12. Bulgaria has the lowest density: 175 km per 1 000 sq. km and 2.5 km per 1 million citizens.

In terms of topological aspects, both road and railway networks in Romania have an acceptable structure. The spatial accessibility of the most important socio-economic centres (about 50 cities), in relation to the main electrified double-tracks and the main national roads, is displayed in Figure 1 and Figure 2 respectively.

Two relative small territories in the north and to the south of the Carpathian Mountains are not covered by the railway infrastructure.

Figure 1: Spatial accessibility of the main Romanian railways

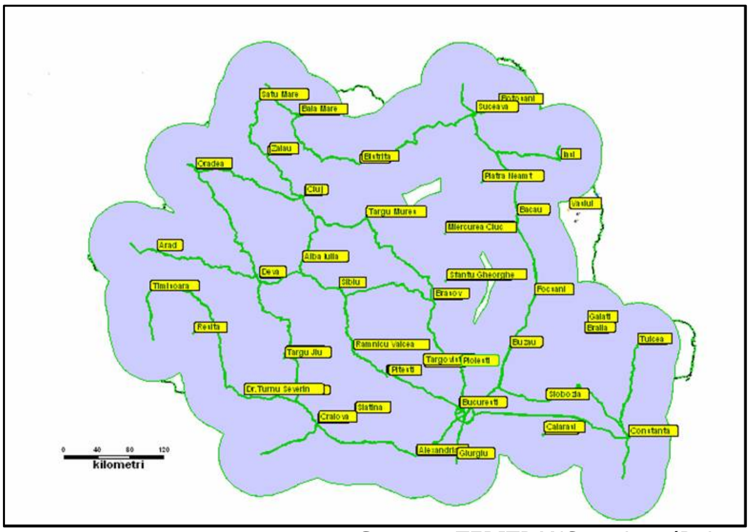


(50 km between any of the most important economic centres and a link of main railway network)

un-electrified line
electrified line

Source: TERITRANS project (Raicu, 2007)

Figure 2: The spatial accessibility of the main Romanian roads



(50 km between any of the most important economic centres and a link of Romanian national roads)

Source: TERITRANS project (Raicu, 2007)

However, Romania still has an advantage: a well-connected and well-structured railway network, even if this is in a poor condition. Significant progress has already been made: separation of TI management from the operational use of TI. Instead of the new and costly motorways (other than TEN-T projects), railway network upgrading may be a wiser decision for TI development in Romania. Moreover, the 'nimby' syndrome (Saint at al, 2009) of Romania's affected population is extending: it seems that nobody wants to give up their land for TI development.

As for the other transport modes, a short review indicates the same trends: in the EU-15 the inland waterways are growing and the most important airports (meaning hub airports with more than 10 million passengers per year) are located in the EU-15 (see Table 6 and Table 7).

Table 6: Inland waterways - length in use (navigable canals, rivers and lakes regularly used for transport)

	Km						
	1990	1995	2000	2003	2004	2005	2006
EU-27		38 963	41 152	40 946	42 808	42 870	43 011
EU-15	29 474	29 608	32 169	32 021	33 889	33 950	34 091
EU-12		9 355	8 983	8 925	8 919	8 920	8 920
EU-10		7 103	6 734	6 676	6 670	6 671	6 671
BG	470	470	470	470	470	470	470
RO	1 782	1 782	1 779	1 779	1 779	1 779	1 779

Source: EU energy and transport in figures. Statistical pocketbook 2009

Table 7: Number of European airports, by number of passengers carried per year

	more than 10 million	5 to 10 million	1 to 5 million	500 000 to 1 million	100 000 to 500 000	15 000 to 100 000
EU-27	31	29	92	43	116	81
EU-15	30	26	77	40	102	72
EU-12	1	3	15	3	14	9
BG			3		1	1
RO			1	2	4	2

Source: EU energy and transport in figures. Statistical pocketbook 2009

A short review of the main problems of the urban TI shows that:

- the urban population is continuously growing due to the 'agglomeration effect', but economic growth has induced residential relocation from the dense residential city zones into the suburbs; in most cases new suburban settlements are mono-functional zones; without a comprehensive strategic plan for urban development, including the Rapid Transit network, most of the inhabitants are captives of road transport (this is the case in most capital cities in the EU-12);

- restoring mobility by healing symptoms of urban road traffic congestion (e.g. trying to suppress traffic bottlenecks, increasing capacity of the main road networks, creating new parking lots or implementing traffic management techniques), is no longer a realistic long-term strategy; experience has shown that in any city where measures were taken to increase the fluidity of traffic, the initial problems reappear some years later in an even more acute form (Duchateau, 1997);
- most of the European cities have an historical development and hence, a quasi-circular structure; the TI for passenger transportation follows the city's structure: radial/ circumferential network;
- if the urban network is Rapid Transit-based, with adequate coverage throughout the central area and close suburbs, having at least one station close to each major activity zone with good connectivity among lines requiring no more than one transfer and convenient transfer between lines, then the urban network is called 'ubiquitous' and most of the travellers' needs may be fulfilled in a sustainable manner. The Paris Metro network is an example of this (Vuchic, 2005). It covers the entire urban area well: no point within the central city is more than 500 m from a metro station. Munich, Madrid and some other capital cities also have many elements of the ubiquitous network pattern;
- despite the recognised potential benefits from rail-based services at airports, the degree of air-rail intermodality still varies between Europe's largest airports. The main rationale for rail-based connections to airports is the need to bring passengers to (or from) the airport. This need increases with growing congestion on roads, which is often especially severe around airports. The development of the HSR, which can increase the airport's catchment area and on some routes can substitute for aircraft, provides an incentive to connect airports with HSR;

For the urban TI in the NMS, the Bucharest case is presented briefly:

- Bucharest's total surface is about 228 sq. km and its street network has a total length of about 1 820 km. The public surface route length (trams, buses and trolley buses) is about 2 000 km (about 2 millions trips per day). There is also an underground network with 49 stations and 67 km length (average distance between stations - 1.5 km) and about 60 000 daily trips;
- Bucharest has about 2 million inhabitants and an average population density of about 8 107 inhabitants/sq. km, which is quite high compared with other European capitals. Romania is a car producer and also a car importer. Over recent years, Romania has faced an increasing motorisation rate. Obviously, that has happened because of general economic development (about 7-8% per year – average rate of economic growth after the EU pre-accession decision, until the end of 2008). The streets' infrastructure is almost blocked – there is no additional space for capacity development. Moreover, there was a quite slow rate of street surface rehabilitation work. Public transportation has not achieved the high quality required in order to attract people, even though a large percentage of Bucharest's inhabitants are public transport captives. Only a few exclusive LRT lines were built, but their service is highly appreciated by Bucharest's citizens. An ordinary rail service using an old railway connection to Bucharest International Airport was recently established after a long debate.

Successful or unsuccessful implementation of transport policies depends on institutional structures and institutional processes. There are several important elements which make the difference:

- the role of national government,
- the degree of centralisation,

- institutional consolidation,
- the role of the private sector,
- the degree of regulatory intervention and
- the coordination across transport modes.

Key findings

- The proposed project selection in the field of priority projects contributes to the Commission's objective in terms of sustainable development. Three quarters of the funding is allocated for railway projects and another 11.5% is reserved for inland waterways. The support for road and air transport is more limited;
- Implementation of the trans-European transport networks requires substantial amounts of funding. Based on the revised information from the Member States, the overall cost of the network is EUR 900 billion, and nearly EUR 500 billion still needs to be invested to 2020. Completion of the priority projects alone requires more than EUR 250 billion by 2020;
- Significant parts of the 30 priority projects will not be realised until 2010, 2015 or even 2020;
- The EU cohesion goal is unfulfilled: there are differences in TI project completion among the EU-27 but also among EU-12 Member States. The TI of the last two Member States to accede to the EU is in a poor condition;
- In EU-15 states the inland waterways are growing and the most important airports (meaning hub airports with more than 10 million passengers per year) are located in the EU-15;
- In most cases, new suburban settlements are mono-functional zones; without a comprehensive strategic plan for urban development, including the Rapid Transit network, most of the inhabitants are captives of the road transport (this is the case in several capital cities in EU-12 states);
- Increasing capacity of the main road networks, creating new parking lots or implementing traffic management techniques is no longer a realistic long-term strategy; experience has shown that in any city where measures were taken to increase the fluidity of traffic, the initial problems reappear some years later in an even more acute form;
- If the urban network is Rapid Transit-based, most of the travellers' needs may be fulfilled in a sustainable manner;
- Despite the recognised potential benefits from rail-based services at airports, the degree of air-rail intermodality still varies between Europe's largest airports;
- Successful implementation of transport policies depends on institutional structures and institutional processes. There are several important elements which make the difference, as follows: the role of national government, the degree of centralisation, institutional consolidation, the role of the private sector, the degree of regulatory intervention and the coordination across transport modes.

3. A VISION FOR THE FUTURE OF THE EU'S TRANSPORT INFRASTRUCTURE AT THE 2050 HORIZON

3.1. The future of the EU’s transport infrastructure according to the TRANSvision scenarios

Accurately predicting long-term development is a difficult task. Despite this, it is possible and useful to consider the development scenarios, taking into consideration two dimensions of uncertainty: the first is related to economic growth, measured by GDP, and the second is related both to the quality of human well-being and to ecosystems, measured by a composite index (Fahy and Cinneide, 2006).

Four exploratory scenarios of future transport in Europe were described (Petersen et al., 2009). ANNEX 3 gives us a synthetic description of the key features of the four scenarios. The qualitative description of the exploratory scenarios uses the key drivers of change as follows: society, economy, energy, technology, environment, policy, and transport itself. Table 8 reveals in more detail the main characteristics of the EU’s future transport infrastructure, which will support each of the four scenarios.

The description of TI development considers the main strategic EU development directions: first strategic direction – Europe’s economic competitiveness vis-à-vis third countries (e.g. USA, China, Japan); second strategic direction- intra-EU competitiveness; third strategic direction – an environment-friendly and life-sustaining urban/local space.

In order to obtain an easier indication of the uncertainties dimensions, the sign (+) is attached to a positive economic trend, and the sign (—) is attached to a negative economic trend. Similarly, the same signs indicate the quality of human well-being and the ecosystems trend.

The selected features (in bold) point out the specific parts of the future TI, having high expectations in terms of the above-mentioned key drivers; italics indicate the effects of a very strict regulatory policy in terms of environmental protection.

Table 8: The future of the EU's transport infrastructure at the 2050 horizon

1. HYPER-MOBILITY (UNHAPPY GROWTH)		
EU's competitiveness	Intra-EU competitiveness	Local/urban space
Economy (+); Human well-being (—); Ecosystems (—)		
- EU **hub-and-spokes airport structure is dense and growing**; - all the **EU maritime ports are growing and pressing on their neighbourhood**, especially for land-use extension; - **ICT & ITS are intensively used**, but there are still unsolved congestion problems; - EU economy is competitive.	- **all priority projects of the TEN-T networks** are finished, because of the abundance of funds - **road and motorway networks provide good accessibility, even if the main routes are congested:** EU territorial cohesion and fair competitiveness are progressing, **- HSR still has a low density**; - **local airports are growing**, as are various problems resulting from generated external effects; their connection to the urban areas is still road-based in most cases.	- **new urban street networks** at different levels, connecting high towers, but **transit services are not yet integrated**, and congestion is extremely high, - urban planning is still transport-uncorrelated; - **ICT & ITS are largely used** – the virtual world is growing, - an extended network for parking lots 'asphyxiates' urban spaces.
2. **SUSTAINABLE-DECOUPLED MOBILITY (HAPPY GROWTH)**		
EU's competitiveness	Intra-EU competitiveness	Local/urban space
Economy (+); Human well-being (+); Ecosystems (+)		
- a selection of the most important EU hub airports is already made and only their TI is large enough and equipped to support all passenger and cargo flows of EU; ***only a small number of well-located airports are operational***; - **all the EU's maritime ports are developed** and well-equipped; they are railway-fed; - **logistic highly equipped platforms** are growing; - **ICT & ITS are very well-developed**. EU economy is competitive.	- EU's **inland waterway** network is increasingly used; - **the EU's extended railway network provides separate services for passengers and freight**; - **inland ports are connected to rail terminals**; - **logistic platforms use ICT & ITS** ***- motorways have the same density as in 2020***. The road network has the same density as in 2020; it is well-maintained, feeding the railways and inland waterways. EU territorial cohesion and fair competitiveness are accomplished.	**- urban and peripheral networks are well-integrated;** **- the rail terminals are veritable interchanges in the urban space with multiple nuclei structure;** **- LRT and underground networks are extended;** **- BRT services are extended, improving urban accessibility;** **- monorail network is developing in very dense cities.** Ubiquitous rail-based network supports an environment-friendly and life-sustaining urban/local space.

Table 8 (continued)

3.COLLAPSE-REDUCED MOBILITY (HAPPY DECELERATION)		
EU's competitiveness	Intra-EU competitiveness	Local/urban space
Economy (—); Human well-being (+); Ecosystems (+)		
-only a few airports are selected for international passenger traffic (there is a collapse of tourism and a low level of emigration); their infrastructure is at the 2020 stage; - only the best positioned maritime ports are used for freight traffic, and their infrastructure is at the 2020 stage	- EU cohesion and integration are not accomplished; **TEN-T networks are not completed**, but the level of traffic is low; -TI is at the 2020 stage, but **ordinary rail networks are well-maintained and utilisation is encouraged**.	- **street networks are well-maintained and used especially for non-motorised transport**; - financial constraints relieve car traffic congestion.
4. CARBON-CONSTRAINED MOBILITY (UNHAPPY DECELERATION)		
EU's competitiveness	Intra-EU competitiveness	Local/urban space
Economy (—); Human well-being (—); Ecosystems (—)		
-TI is in poorer condition than at the 2020 stage; there is no funding for the large ports and airport maintenance; -TI is decreasing in terms of spatial density.	-TI is in a poorer condition than at the 2020 stage; there is no funding for network maintenance; -TI is decreasing in terms of spatial density.	-TI is in a poorer condition than at the 2020 stage; there is no funding for network maintenance; -TI is decreasing in terms of spatial density.

Source: The author

Key findings

- The normative approach of the ETP makes a difference between the first and the second scenario, which are based on economic growth. Only weak regulations in terms of human well-being and ecosystems are taken into account in the first scenario. In fact, this scenario may be called the 'weak regulation' scenario;
- By contrast, the sustainable-decoupled mobility scenario requires a strong regulated frame of the ETP.
- The ICT and ITS are a constant feature of both scenarios; there is no need for regulation of their involvement and development into TI projects: ICT and ITS have 'naturally' developed into the transport domain.

The strong regulated frame of the ETP related to TI development according to the 'decoupled-mobility growth' scenario contains at least the following sets of features:

The first set: TI planning features, as follows:

1.1. **norms and standards** for *ex-ante* evaluation of the TI costs (for both monetary costs and shadow prices) and benefits; their values depend only on the TI project scale (EU, regional or local scale);

1.2. **fixed modal priority weights** for the TI project ranking process according to the external effects generated by each of the transport modes: the lower the external effects, the higher the weight adopted for a certain modal TI; the usage of the modal priority weights are irrespective of the countries' conditions: all Member States use the same modal priority weights in their TI planning process. Intermodal rail-rail, rail-waterway, rail-maritime TI terminals have the highest priority weight, followed by rail-based and waterway TI projects having high priority weight, then maritime ports, and finally the road TI projects have the lowest priority weights (the above-mentioned intermodal terminals are the key factor in the railway transport failure in recent decades);

1.3. the **highest priority weight for upgrading** TI existing links and terminals, and the lowest priority weight for the new TI building are adopted;

1.4. the **same and transparent decision-making methods for TI project ranking is used across the MS**: the adopted methods have a large acceptance from the research community side; the adopted methods are related to the TI project scale;

1.5. **systematic *ex-post* monitoring** of the TI costs and benefits during a standardised period of TI usage, depending on the TI scale;

The second set: TI construction management and financial features, as follows**:**

2.1. **norms and standards** for the **TI works durations;** they have tabular min. and max. values depending on TI scale, complexity and geological conditions; strict monitoring scheme of the work durations is imposed;

2.2. **public-private partnership is strongly encouraged**: a certain percentage of the total TI projects has to be completed via a PPP scheme: this percentage will increase gradually; all EU-27 countries accept the same percentage of PPP from the total TI costs during a certain period of time (e.g. four or five years); PPP scheme refers to the building, financing and operation;

2.3. programmes of **financial incentives for industry support** in TI building (the industry operators are different from the PPP participants);

2.4. **improved institutional structure for TI development**: the EU-12 countries, and indeed others, need help to manage the large TI projects and related funds; the most TI 'productive' and successful institutional structures around the EU and the world are considered for structure transfer or/and for adjusting to the various national formal and informal conditions;

The third set: TI usage features, as follows:

3.1. **'user-pays' principle implemented** on large scale for individuals;

3.2. **greenhouse gas emission allowance trading** (ETS) within the EU in order to promote reductions of greenhouse gas emissions in a cost-effective and economically efficient manner, for companies.

The legislative experience of the European Commission for ETS implementation in the aviation domain is also used in the following transport fields:

- mass road transport;
- control of the motorisation rate (car ownership) in certain congested urban areas;
- control of the total cars x km in congested urban areas (the drivers buy emission allowances on the local free market);
- control of real estate development into the suburbs without public transportation (the developers buy the emission allowances and their price depends on the car traffic congestion generated by the new settlements).

3.2. The nature of the risks in the EU's transport infrastructure projects

Risk is the possibility that events, their resulting impacts and their dynamic interaction will turn out differently than anticipated.

The most frequent risks that managers identified as important in TI mega-projects (Miller & Lessard, 2008) are the following:

a) Completion risks: Technical; Construction; Operational;
b) Market-related risks: Market; Financial; Supply;
c) Institutional risk: Regulatory; Social Acceptability; Sovereign.

Unpredictability of the moments where the scientific results turn into technological progress represents a fourth class of risks. A good example to prove this risk is the case of several French domestic airports (with low accessibility due to car traffic congestion) competing with - at that time – the new TGV (*Train à Grande Vitesse*), which travels at 500-600 km.

Any strategic vision on long-term TI development has to analyse the sensitivity of the proposed project set in relation to the most predictable innovations in TI.

The most likely characteristics of a new future transport system (derived from a 'revolutionary' technological innovation), with high influence on the future TI, are:

- high speed, higher than speed of the latest aircraft generation;
- low renewable energy consumption and low emission;
- low investment for infrastructure, vehicles and technology;
- high frequency of vehicles and hence high transport capacity;
- low complexity of operations;
- passenger services and also freight service provision.

Taking into account these main characteristics of the new and 'revolutionary' transport mode, the airport and maritime port infrastructure seem to be the most affected TI.

Research is required on the airport or maritime port infrastructure, in order to transform it into a veritable interchange terminal (in relation with the new transport mode) at an early stage of the TI strategy.

4. CONCLUSIONS

- The communication ‘A Sustainable Future for Transport: towards an integrated technology-led and user-friendly system’ is a comprehensive document synthesising the policies, instruments and guiding methods to translate the defined vision for the transport future into effective policy actions and gives a justified **important position to ‘Infrastructure: maintenance, development and integration of modal networks**’ among the other six implementation actions of ETP.
- The proposed project selection in the field of **priority projects contributes to the Commission's objective in terms of sustainable development**. Three quarters of the funding goes to railway projects and another 11.5% is reserved for inland waterways. The support for road and air transport is more limited;
- Implementation of the **trans-European transport networks requires substantial amounts of funding.** Significant parts of the 30 priority projects will not be realised until 2010, 2015 or even 2020;
- **The EU cohesion goal of the ETP has not been achieved yet**: there are differences in TI project completion among the EU-27, but also among EU-12 Member States. The TI of the last two Member States to join the EU is in poor condition;
- In most cases, new suburban settlements are mono-functional zones; **without a comprehensive strategic plan for urban development, including a Rapid Transit network, most of the inhabitants are captives of the road transport**, generating car traffic congestion (this is the case in most capital cities in the EU-12);
- **Increasing capacity of the main road networks, creating new parking lots or implementing traffic management techniques is no longer a realistic long-term strategy**;
- Despite the recognised potential benefits from rail-based services at airports, **the degree of air-rail intermodality still varies between Europe’s largest airports**;
- **Successful implementation of transport policies depends on institutional structures and institutional processes**. There are several important elements which make the difference, as follows: the role of national government, the degree of centralisation, institutional consolidation, the role of the private sector, the degree of regulatory intervention and the coordination across transport modes.
- **There are two development scenarios involving overall economic growth: ‘hyper-mobility’ and ‘sustainable-decoupled mobility’;** TI development is possible only in these two scenarios. The ICT and ITS component is a constant feature of both scenarios.
- The normative approach of the ETP makes a difference between the first and second scenarios. If regulation in terms of human well-being and ecosystems in the TI strategy is weak, then the first scenario will happen.
- By contrast, **the sustainable-decoupled mobility scenario requires a strong regulated frame of the ETP, with norms and standards for all stages of TI project implementation, from the decision-making stage to post-implementation monitoring**;
- Any strategic vision on **long-term TI development has to analyse the sensitivity of the proposed project set in relation to the most predictable innovations in TI**.

Below, a non-exhaustive list is presented of the most important policy guidelines, as amendments of the ETP, leading to TI sustainable development:

√ **The EU's transport infrastructure development and TEN-T priority projects should continue in line with the European Union's key objectives**: to cover the whole territory of the Member States so as to facilitate economic growth, territorial cohesion, sustainable mobility of persons and goods, and Europe's competitiveness;

√ **The norms and standards** for the *ex-ante* evaluation of the TI costs (both monetary costs and shadow prices) and benefits should be adopted, depending only on the TI project scale (EU, regional or local scale), irrespective of the countries' conditions; iterative improvement of the norms and standards in a strict *ex-post* monitoring frame have to be considered as well;

√ **A comprehensive and hierarchical frame of the priority weights for the decision-making process for TI projects should be put in force:** the upgrading TI projects have the highest priority; inside the upgrading projects the intermodal rail-based terminals projects have higher priority against the other mode TI upgrading; the set of the new TI is a lower priority and inside this set of projects the intermodal rail-based terminal has higher priority against the other new TI.

√ **The norms and standards** for the **TI works durations** and also the strict monitoring of the accomplished durations are necessary; all the MS have to adopt them;

√ **Public-private partnership schemes must be encouraged or pushed by imposing a** certain percentage of the total TI projects which has to be completed in a PPP scheme; all EU-27 countries have to accept the same PPP percentage in total planned TI projects over a certain period of time (e.g. four or five years);

√ **Institutional structure for TI development has to be gradually improved** using the most 'productive' and successful institutional structures example, in relation to TI strategic development;

√ **Extending the greenhouse gas emission allowance trading system** (ETS) at least to the mass road transports (using the recent legislative experience in aviation). ETS, along with intermodal rail-based terminals upgrading and ITS and ICT solutions, is leading to the railway shift of the long-distance and massive road **freight transports in the medium and long-term;**

√ **ETP should encourage research and higher education networking** with special subjects relating to the TI project development strategy, considering the high level of interdisciplinary involvement (engineering, economics, sociology, environmental issues, architecture, psychology, management).

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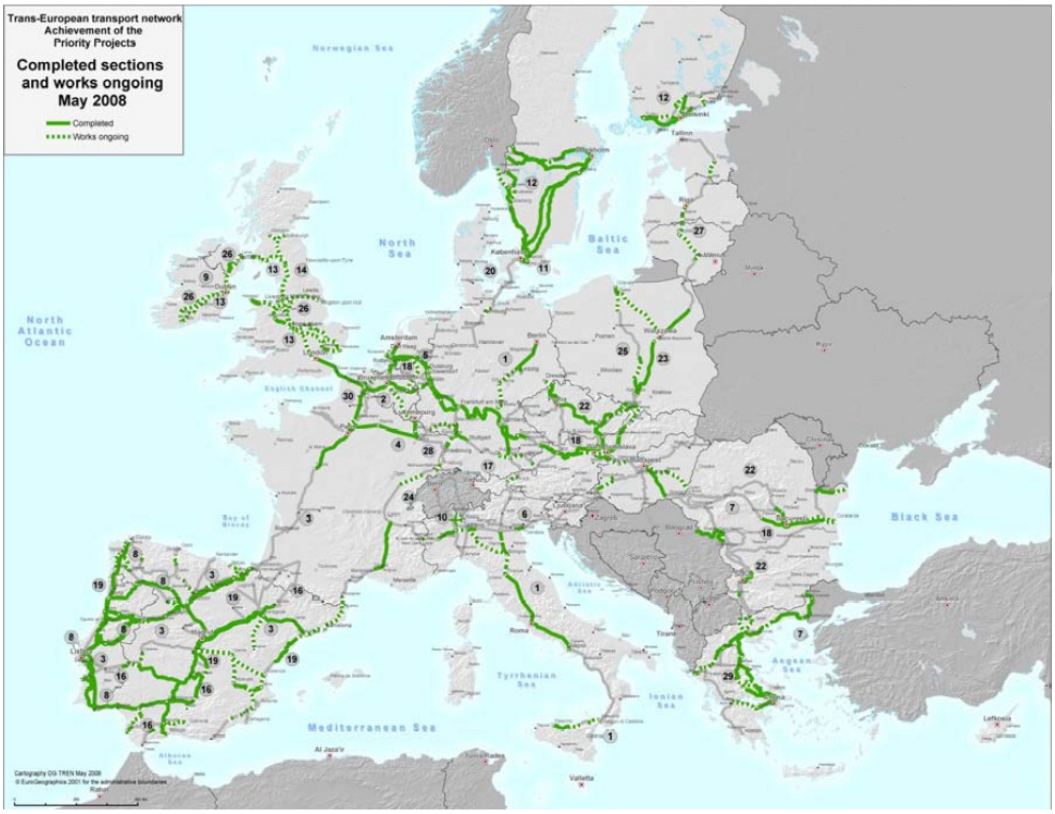
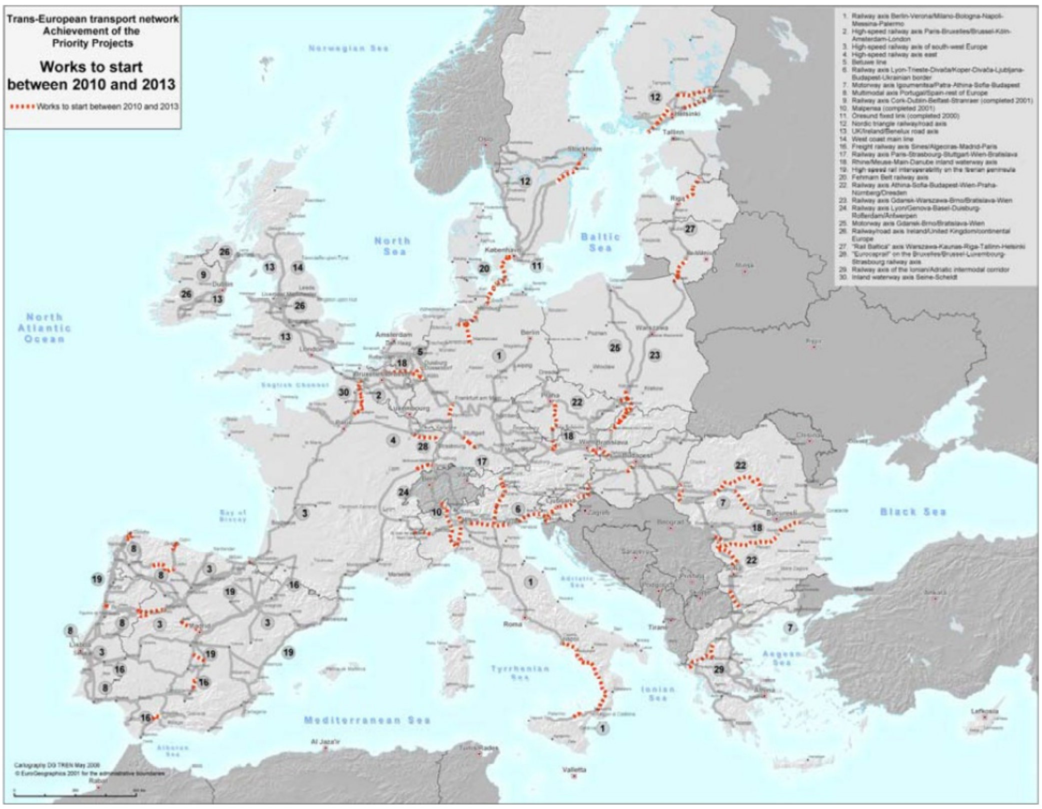
ANNEX 1: TI priority projects – selection for the EU-12 states

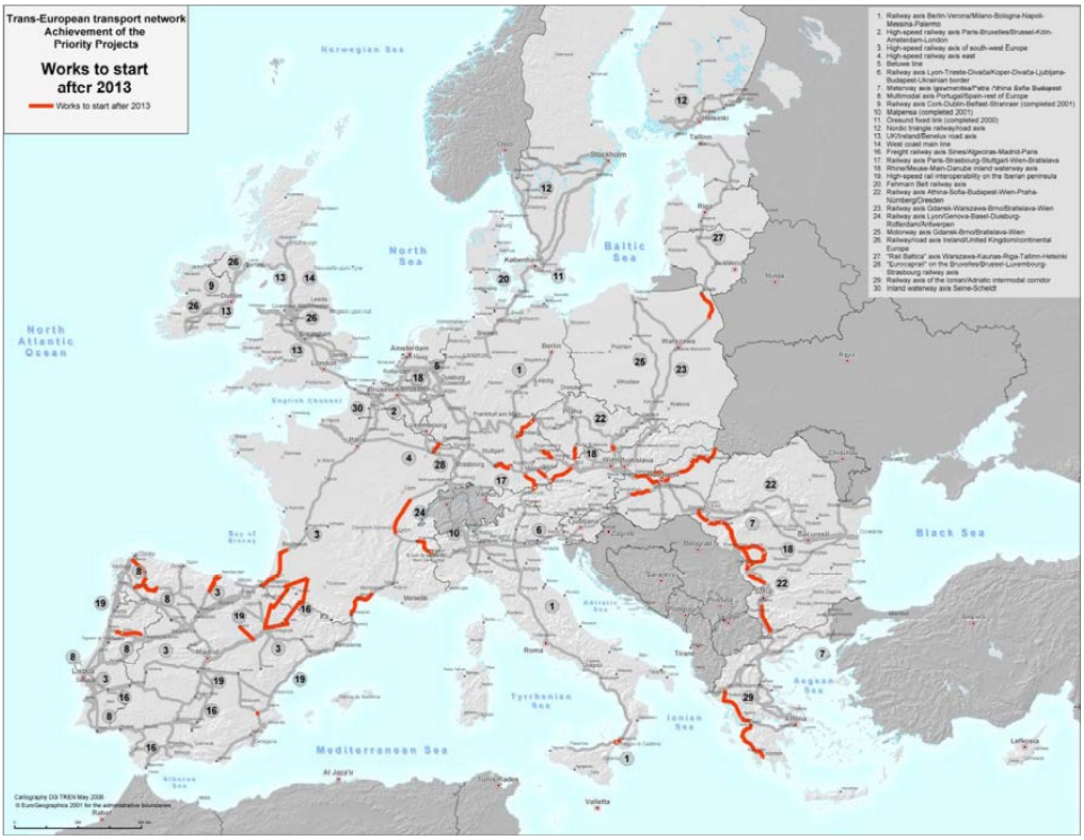
#Priority Project	Component Projects	Total cost [Euro]	EU Contribution [Euro]	Percentage of EU support:		Start date:	End date	Member States involved
				Type	Percent			
Priority Project 6 Railway axis 'Lyon-Trieste-Divača/Koper-Divača-Ljubljana-Budapest-Ukranian border'	**1) 2007-EU-06010-P**							
	Studies for preparation of approval of the railway line section Budapest-Keleti-Miskolc-Nyiregyhaza	16,000,000	8,000,000	Studies	50%	March 2009	December 2011	Hungary
	2) 2008-SI-92400-S							
	Working out of preliminary studies for the construction of the new line of high capacity/high speed line Divaca-Ljubljana	700000	350000.00	Studies	50%	July 2009	April 2011	Slovenia
Priority Project 18 Waterway axis Rhine/Meuse-Main-Danube	**3) 2007-HU-18090-S**							
	Improvement of the navigability on the Danube	8,000,000	4,000,000	Studies	50%	March 2008	December 2010	Hungary
	4) 2007-RO-92301-S							
	D. A. N. U. B. E.: Danube Access Network – Unlocking Bottlenecks in Europe, by developing a high quality TEN-T ports infrastructure in Romania on optimal economic terms – Feasibility study phase	400,000	200,000	Studies	50%	March 2008	July 2009	Romania
Priority Project 21 Motorways of the Sea	**5) 2008-EU-21015-P**							
	Motorways of the Sea projects in the Baltic Sea Area Klaipéda-Karlshamn link	26,040,000	5,240,000	Studies	50%	August 2008	December 2013	Sweden, Lithuania
				Works	20%			
Priority Project 22 Railway axis Athina–Sofia–Budapest–Wien–Praha–Nürnberg/Dresden	**6) 2007-EU-22070-S**							
	Studies for the development of the Railway Priority Project 22	13,000,000	6,500,000	Studies	50%	January 2008	December 2013	Greece, Bulgaria, Romania,
	7) 2007-HU-22020-S							
	Preparation of design for approval for the railway line section Biatorbagy (incl.)-Tata (excl.)	2,500,000	1,250,000	Studies	50%	January 2009	December 2012	Hungary
Priority Project 23 Railway axis Gdansk – Warszawa – Brno / Bratislava - Wien	**8) 2007-CZ-90501-S**							
	Reconstruction of the Railway Station Přerov	3,690,000	1,845,000	Studies	50%	April 2008	January 2009	Czech Republic
	9) 2008-PL-92001-S							
	Preliminary Feasibility Study for the task: modernisation and expansion of the Katowice Railway Junction	1,000,000	500000.00	Studies	50%	December 2008	Septembe r 2010	Poland
	10) 2008-SK-92307-S							
	Modernisation of corridor, state border CR/SR – Cadca-Krásno nad Kysucou (outside) railway track	964000	480000.00	Studies	49.79%	March 2009	June 2011	Slovak Republic
Priority Project 25 Motorway axis Gdansk – Brno / Bratislava - Vienna	**11) 2007-PL-92101-S**							
	Materials for environmental decision, materials for localisation decision, building design and tender documentation for the building of the S19 expressway, section Lutoryz-Barwinek	8,700,000	3,450,000	Studies	39.7%	December 2007	December 2010	Poland
	12) 2007-PL-92103-S							
	Design documentation, building design, tender dossier for S5 expressway, sections: Nowe Marzy-Bydgoszcz and Žnin-border of wielkopolskie Voivodship and border of kujawsko-pomorskie Voivodship-Gniezno	12,000,000	4,760,000	Studies	39.7%	October 2007	June 2010	Poland
	13) 2007-SI-60460-S							
	Implementation of the GSM-R system in Slovenian railway network	3,400,000	1,700,000	Studies	50%	October 2008	May 2011	Slovenia
Priority Project 27 "Rail Baltica" axis: Warsaw-Kaunas-Riga-Tallinn-Helsinki	**14) 2007-EE-27010-S**							
	Studies for a European gauge line for Rail Baltica (Estonian section)	2,000,000	1,000,000	Studies	50%	February 2009	December 2013	Estonia
	15) 2007-EE-27020-P							
	Cross-border section Tartu-Valga railway reconstruction / upgrading	39,841,000	10,750,000	**Works**	27%	Septembe r 2007	December 2010	Estonia
	16) 2007-LT-27030-P							
	1) Building of new European gauge line on the cross-border section PL border-Marijompole, 2) Cross-border section Siauliai-LV boder	269,630,000	72,800,000	**Works**	27%	July 2010	December 2013	Lithuania
	17) 2007-LT-27040-S							
	Studies for Rail Baltica, Lithuanian part	32,140,000	16,070,000	Studies	50%	2008	2013	Lithuania
	18) 2007-LV-27050-S							
	Studies for a European gauge line (Latvian studies)	2,200,000	1,100,000	Studies	50%	Septembe r 2008	December 2012	Latvia
	19) 2007-LV-27060-P							
	1) Reconstruction/upgrading: cross-border section north Valmeira-Valka and cross-border section south Jelgava-LT border 2) Reconstruction/upgrading Jugla (Riga city border station)-Valmiera	96,441,562	22,330,000	**Works**	23.15%	May 2008	December 2013	Latvia
	20) 2007-LV-91801-S							
	Integration of Riga City and Riga Port into the TEN-T network: Completion of studies for Riga Northern Transport Corridor	11,000,000	5,500,000	Studies	50%	October 2007	June 2012	Latvia
Total		**525,646,562**	163,125,000		31.03%			
		of which -woks	**111,120,000**		0.2113968			

ANNEX 2: COMPLETED SECTIONS, ONGOING WORKS AND FUTURE WORKS OF THE TEN-T NETWORK





ANNEX 2 (CONTINUED)



Source: TEN – T.Trans-European Transport Network Implementation of the Priority Projects . Progress Report. 2008

ANNEX 3: KEY FEATURES OF THE SCENARIOS AT THE YEAR 2050

Key drivers:	KEY EVENTS/FEATURES OF THE SCENARIOS AT THE YEAR 2050			
	'Hyper-mobility'	'Sustainable-decoupled mobility'	'Collapse-Reduced mobility'	'Carbon-constrained mobility'
SOCIETY				
- Population growth	Moderate increase of EU population	Growing EU population	Strong reduction of EU population	Low increase of EU population
- Population ageing	Marked ageing, but limited due to immigration	Moderate ageing	Strong ageing	Strong ageing
- Migration	High increase of immigration	Moderate immigration	Low level of immigration	Very low immigration
- Urbanisation	Urban sprawl	Accelerated (compact) urbanisation	De-urbanisation: smaller communities	Compact urbanisation
- Work-time regimes; tele-working	Telepresencing is almost a 'lifestyle'	Diffusion of telework and flex-work regimes	Use of short-hop wireless systems	Diffusion of tele-work
- Tourism and leisure	Continuous growth of world tourism	Development of personal services related to 'tourism' (business, health, etc)	Collapse of tourism	Reduction of world tourism
- Lifestyles	Rising life stress Rampant consumerism Increasingly automated delivery of services (self-service)	Increasing sustainable consumption and lifestyle	Social breakdown Local lifestyle	Strong social impact of carbon entitlements
- Safety	EU road fatalities halved as compared to 2006 level (to 20 000 deaths per year) thanks to driver assistance	Reduction of road fatalities thanks to the increased use of sustainable modes	Reduction of road fatalities due to the drastic reduction of traffic	Almost-zero road accidents target achieved thanks to the drastic reduction of traffic and the diffusion of intelligent speed control
- Security	Private security on the rise. Market-led security provision (including part of defence tasks). Security offered by private cars much valued and improved.	Security enhanced through: i) private-public cooperation with public sector maintaining oversight and private sector sub-contracting, ii) positive and negative incentives for public to cooperate.	Security crisis. Transport becomes a highly hazardous activity, as high unemployment might cause increased crime levels also affecting transport.	Focus on enforcement, control and corrective action.

Key drivers:	KEY EVENTS/FEATURES OF THE SCENARIOS AT THE YEAR 2050			
	'Hyper-mobility'	**'Sustainable-decoupled mobility'**	**'Collapse-Reduced mobility'**	**'Carbon-constrained mobility'**
ECONOMY				
- Growth and productivity	Marked economic growth, with GDP growth in the order of 2.6% per annum.	Lower economic growth (as compared to Hyper-mobility), with EU GDP growth in the order of magnitude of 2.4% per annum. Competitive and sustainable cities. A 'knowledge hubs' economy. Mixed situation for rural areas	Collapse of the world economy, growing at 1.2 % per annum	Slow economic growth, with EU GDP growth in the order of magnitude of 1.3% per annum
- Trade	Continuous growth of world trade	Shift to regional world trade patterns	Collapse of world trade	Shift to regional world trade patterns
- Employment	The EU employment rate will increase to about 70%, with greater female participation and share of immigrant workers and elderly	The EU employment rate will remain around the current level (65%)	Reduction of employment rate; less working/hour per day	Reduction of employment rate
- Public budget constraints	Decrease in GDP share of public sector, also due to high growth and tax base extension due to immigrants. Pressure to lower taxes.	Unchanged or moderate increase in GDP share of public sector, pressure of ageing but outsourcing of tasks.	Government finances overburdened	Strong increase in GDP share of public sector, as major challenges are tackled by government.
ENERGY				
- Energy supply	Nuclear energy. Diffusion of hydrogen as energy vector towards 2050	Distributed energy power (microgrids)	Energy shock	Still heavily carbon-dependent, but carbon regulation provides for a carbon-decoupled growth pattern
- Energy demand	Higher efficiency but also high rebound effects of increased mobility	Sustainable buildings	Self-help communities	High fuel efficiency and heavily constrained demand by means of carbon entitlements
- Energy prices	Moderate energy prices increase.	High energy prices (e.g. triple-digit oil prices)	Low energy prices as a consequence of falling demand	High energy prices (e.g. triple-digit oil prices)

Key drivers:	KEY EVENTS/FEATURES OF THE SCENARIOS AT THE YEAR 2050			
	'Hyper-mobility'	'Sustainable-decoupled mobility'	'Collapse-Reduced mobility'	'Carbon-constrained mobility'
TECHNOLOGY				
- New energy infrastructure	Full exploitation of nuclear energy.	Full exploitation of distributed micro-generation from natural gas and renewable sources. Small energy community networks (microgrids).	Decaying energy infrastructure	Better local infrastructure and services
- New transport infrastructure	Full development of intelligent transport infrastructure, hydrogen distribution infrastructure. Market-led ITS.	City transport infrastructure and innovation. Government-steered ITS	Decaying transport infrastructure	Limited change of the transport infrastructure
- New fuels and vehicles	Drivers' assistance Hydrogen cell application	Drive away from automated public transport	Research on new vehicles has nearly stopped.	Fuel efficiency Biofuel buses
- ICT development	Wireless connection ID devices	Use of ITS mainly in the urban environment	Low-powered communications An eroded information infrastructure technology.	Intelligent speed control
ENVIRONMENT				
- Pollution	More local pollution	Local pollution below air quality control targets	Reduced pollution due to reduced activity in the transport and other sectors.	Less pollution as a side-effect of strict carbon regulation
- Waste	Increasing waste footprint	Zero-waste society	Reduction of waste due to the reduction of production and consumption.	Decreased waste footprint
- Greenhouse gases emissions	Reduction of CO2 emissions to about 52% below 2005 level at 2050.	Reduction of CO2 emissions to about 57% below 2005 level at 2050.	Reduction of CO2 emissions to about 58% below 2005 level at 2050.	Reduction of CO2 emissions to about 35% below 2005 level at 2050.

Key drivers:	KEY EVENTS/FEATURES OF THE SCENARIOS AT THE YEAR 2050			
	'Hyper-mobility'	**'Sustainable-decoupled mobility'**	**'Collapse-Reduced mobility'**	**'Carbon-constrained mobility'**
- Climate change effects	At the atmospheric concentration of about 550 ppm of CO2-eq, global average temperature increase is going to stabilise at about 3 C° by 2100 and the global average sea level rise at 1.2 metres	At the atmospheric concentration of about 450 ppm of CO2-eq, global average temperature increase is going to stabilise at about 2.2 C° by 2100 and the global average sea level rise at 0.9 metres	Atmospheric concentration of CO2-eq falls below 400 ppm, the global temperature increase below 2 C° and sea level rise below 0.4 metres	At the atmospheric concentration of about 450 ppm of CO2-eq, global average temperature increase is going to stabilise at about 2.2 C° by 2100 and the global average sea level rise at 0.9 Metres. Climate change effects Continuing
- Natural resource consumption	Not specifically in focus within this particular scenario	Not specifically in focus within this particular scenario	Not specifically in focus within this particular scenario	Not specifically in focus within this particular scenario
POLICY				
- EU enlargement & territorial cohesion	Broadened and extended EU, but not deep and maybe with divergent speeds. Market-oriented and greater market convergence with US and MED countries. EU territory characterised by competitive megalopolis and leisure landscapes.	Deepening EU, with divergent speeds; only small enlargements. EU territory featured by polycentric development in green towns, supported by cohesion funds.	EU rendered powerless by Member States acting on their own. EU territory characterised by run-down cities with slums, and migration back to rural areas	Deepening EU but with an 'EU fortress' character. EU territory characterised by compact green megalopolis
- EU integration (Single Market vs Political Union)	Prevalence of the 'Competitive Europe' model	Prevalence of the 'Cohesive Europe' model Increased cooperation at local level (between regions and municipalities)	A fragmented polity	Strong cooperation (Carbon Contraction Agreement)
- EU taxation policy	Pressure to lower taxes, with national tax systems becoming less progressive GHG tax of $25 per tonne of CO2-eq applied in 2008 by OECD countries, 2020 by BRIC and 2030 by the Rest of the World. Taxes on vehicle purchase, registration, use and motor fuels; road and parking pricing. Road tolling used to finance new clean transport technologies.	Pressure of ageing eroding tax bases, not enough compensated by immigrant workers GHG tax set at the level necessary to limit atmospheric concentrations to 450 ppm of CO2-eq in the long term. Full cost accounting and resource taxation	Reduced tax revenues	National tax systems becoming less progressive (shift from labour to carbon taxation) GHG tax set at the level necessary to limit atmospheric concentrations to 450 ppm of CO2-eq in the long term Taxation of resource consumption

Key drivers:	KEY EVENTS/FEATURES OF THE SCENARIOS AT THE YEAR 2050			
	'Hyper-mobility'	'Sustainable-decoupled mobility'	'Collapse-Reduced mobility'	'Carbon-constrained mobility'
- Global trade governance	Full liberalisation, including intellectual property and services.	Linked to global Emission Trading System and Clean Development mechanisms	Tariff and non-tariff outright protectionism	Tariffs re-emerge because of necessity to tackle carbon leakage. Likely regionalisation of world trade.
- Global climate change governance				
TRANSPORT				
- Interurban transport	Growing air transport High Speed Trains Increasing long-distance travel	Growing share of slow modes in passenger transport In freight transport punctuality and reliability are more important than speed. Increasingly priced air transport Increasingly priced rail transport. Less passenger travel need. More rational freight transport	Hard travel Slow transport patterns Decline of long-distance trips	Inescapable carbon regulation and control Long-distance traffic increases at a low rate
- Urban transport	Flexible local public transport Increasing volumes of traffic	Slower passenger and freight transport growth compared to GDP growth Road pricing More intensive use of public transport in urban areas	Slow transport patterns Markets grow mostly locally Average trip length decreases	Increasing public transport commuting Reduced volumes of traffic Inescapable carbon regulation and control Average trip length decreases

Source: TRANSvision. Report on Transport Scenarios with a 20 and 40 Year Horizon. Task 1 – Qualitative Analysis, Feb.2009

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