

DIRECTORATE-GENERAL FOR INTERNAL POLICIES

POLICY DEPARTMENT **B**
STRUCTURAL AND COHESION POLICIES

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**TEN-T LARGE PROJECTS -
INVESTMENTS
AND COSTS**

STUDY





DIRECTORATE-GENERAL FOR INTERNAL POLICIES
POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES
TRANSPORT AND TOURISM

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STUDY

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

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LINGUISTIC VERSIONS

Original: EN

Translations: DE, FR

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Manuscript completed in April 2013

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This document will be available on the Internet at:

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Abstract

Based on a literature review and ten case studies, this study elaborates recommendations for improving strategic planning, the choice and definition of projects as well as a sound assessment for transport and socio-economic impacts. The role of transparent information regarding ex-ante planning and ex-post success is studied to support EU co-funding decisions and the monitoring of project implementation.

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LIST OF ABBREVIATIONS

AECOM	Consulting Company, Headquarters Los Angeles
ASTRA	System Dynamics Model
BBT	Brenner Base Tunnel
BBT SE	Brenner Base Tunnel Company
BCR	Benefit-cost ratio
CBA	Cost-benefit analysis
CEF	Connecting Europe Facility
CF	Cohesion Fund
CGE	Computed General Equilibrium Model
CIA	Climate Impact Assessment
CLG	Constraint Logic Programming
COMP	Scenario in the context of core network assessment
CORE	Scenario in the context of core network assessment
COWI	Consulting Company, Headquarters Copenhagen
CSF	Common Strategic Framework
CSIL	Centre for Industrial Studies, Research Institute, Milan
DEGES	Planning Company, Berlin
DETR	UK Department of the Environment, Transport and the Regions
DfT	UK Department for Transport
DG MOVE	Directorate-General for Mobility and Transport
DG REGIO	Directorate-General for Regional and Urban Policy
DKM	Consulting Company, Headquarters Dublin
EBRD	European Bank for Reconstruction and Development
ECA	European Court of Auditors
ECMT	European Conference of Ministers of Transport
ECU	European Currency Unit

EEIG	European Economic Interest Grouping
EERP	European Economic Recovery Plan
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIF	European Investment Fund
EIRR	Economic internal rate of return
ENPV	Economic Net Present Value
ERDF	European Regional Development Fund
ERTMS	European Rail Traffic Management System
ESTO	European Science and Technology Observatory
EVA-TREN	Improved decision-aid methods and tools to support evaluation of investment for transport and energy networks in Europe (research project)
FIRR	Financial internal rate of return
GDP	Gross domestic product
GHG	Greenhouse Gas Emissions
GVA	Gross value added
HEATCO	Developing Harmonised European Approaches for Transport Costing and Project Assessment (research project)
HSR	High-speed rail
IASG	Impact Assessment Steering Group
IASON	Integrated Appraisal of Spatial Economic and Network Effects of Transport Investments and Policies (research project)
IHS	Institut für höher Studien, Vienna
INCA	Incident Cost-Benefit Assessment (spreadsheet based)
INFRAS	Consulting Company, Zurich, Bern
IO	Input Output
IRR	Internal Rate of Return
ISPA	Financial Instrument for Structural Policy Assistance for Accession
ITF	International Transport Forum

- ITS** Supporting Telecommunication Systems
- IWW** Institut für Wirtschaftspolitik und Wirtschaftsforschung, Karlsruhe
Institute of Technology
- JASPERS** Joint Assistance to Support Projects in European Regions
- KfW** Kreditanstalt für Wiederaufbau
- LGTT** Loan Guarantee Instrument for TEN-T Network
- MAP** Multi-annual programme
- MCA** Multi-criteria analysis
- MEGA** Metropolitan European Growth Areas
- MIP** Multi-annual indicative programme
- MoS** Motorways of the Sea
- MTA** Massachusetts Turnpike Authority
- NPV** Net present value
- NUTS** Nomenclature of Territorial Units for Statistics (Eurostat)
- OP** Operational Programme
- OMEGA** Centre for Research on Large Transport Investment Projects. Bartlett
School. University College. London
- OPT** Operational Programme on Transport
- PP** Priority projects of TEN-T
- PPP** Public-private partnership
- RAMP** Risk Analysis and Management for Projects
- ROCE** Return on Capital Employed
- SCBA** Social Cost Benefit Analysis
- SCGE** Spatial Computed General Equilibrium Models
- SDR** Social Rate of Discount
- SDM** System Dynamics Modelling
- SEA** Strategic Environmental Assessment
- SEA** Società Esercizi Aeroportuali, Milan airport operator (only used in
case study on Malpensa airport)

- SEITT** State Company for Land Transport Infrastructure
- SFF** Structured Finance Facility
- SNCF** Société Nationale des Chemins de Fer
- TEM** Transeuropean Motorways
- TEN** Trans-European Networks (communication, energy, transport)
- TEN-STAC** Scenarios, Traffic Forecasts and Analysis of Corridors on the Trans-European Network (research and consultancy project)
- TEN-T** Trans-European Transport Networks
- TEN-T EA** TEN-T Executive Agency
- TER** Transeuropean Railways
- TINA** Transport Infrastructure Needs Assessment
- TIPMAC** Transport Infrastructure and Policy: A Macroeconomic Analysis for the EU (research project)
- TUBA** Transport User Benefit Appraisal, current version on WebTAG
- UIC** International Union of Railways
- UNECE** United Nations Economic Commission for Europe
- VDE** Verkehrsprojekte Deutsche Einheit
- VOT** Value of time
- VREF** Volvo Research and Educational Foundations
- WCML** West Coast Main Line
- WebTAG** UK Department for Transport Web-based Multimodal Guidance on Appraising Transport Projects and Proposals

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EXECUTIVE SUMMARY

Aim

The purpose of this study is to describe and analyse the process of assessing and selecting large transport projects for EU co-funding. The literature identifies several operational problems in such assessments and the study should present conclusions and propose policy recommendations on how such operational problems could be avoided in the next programming period of TEN-T development. The focus should be on the assessment of socio-economic benefits and costs, including the impact on the environment, and greenhouse gas emissions.

Background

The development of Trans-European Networks (TEN) is a premier issue of European economic and social policy that dates back to the Treaty of Rome (1957), which included the adoption of a Common Transport Policy. It serves the goals of economic development, regional competitiveness, regional and social cohesion and environmental sustainability. With the establishment of the European Regional Development Fund (ERDF, 1975) European funding was made available for TEN, with funding options expanded in 1982 by a specific line of the EU budget dedicated to transport infrastructure of European interest. However, the implementation of this infrastructure remained very slow, even after 1982. Therefore, the Treaty of Maastricht (1992) included an obligation for the European Commission and the European Parliament to prepare guidelines for the development of TEN and update them periodically. TEN comprise communications, electricity and transport (TEN-T) infrastructure networks. The first TEN-T guidelines were published in 1996, followed by revisions in 2004 and 2011, the latter proposed for 2014-2020 programming.

The first TEN-T network concept developed top-down by the European Commission had been elaborated by a high-level expert group led by Henning Christophersen, the former Vice-President of the European Commission. The "Christophersen Group" proposed 14 projects which were decided by the Council summit in Essen in 1994 and formed the backbone of the TEN-T guidelines in 1996 ("Essen Projects"). A rough estimate of the budget needed for implementation of the Essen projects amounted to about EUR 96 billion. EU co-financing of up to 10% was decided on (with a budget limit of EUR 1.42 billion), together with financial assistance by the European Investment Bank (EIB) and the European Investment Fund (EIF). The cohesion countries could receive additional funding from the Structural Development Funds (ERDF) and the Cohesion Funds (CF).

The European Court of Auditors (ECA) carried out a number of important audits on the TEN-T funding policy and more broadly on the co-funding of transport projects by the EU. Most relevant were the audits published in 1993, 2006 and 2010. Lack of studies to prove the socio-economic benefits as well as lack of award criteria (conditionalities) to select and prioritise projects on the base of their costs and benefits as well as lack of enforcement of existing award criteria were issues strongly criticized by the ECA.

The proposed revision of the TEN-T guidelines by the European Commission in 2011 intends to overcome fundamental shortcomings. TEN-T projects should fit both into the strategic European transport network, the core network elaborated by an analytic top-down approach and into Strategic Transport Plans to be set up by each Member State. Projects must demonstrate European added value, so that cross-border projects receive particular support. Additionally, the European Parliament is advocating a binding socio-economic Cost-Benefit Analysis (CBA) and a binding Climate Impact Assessment (CIA).

Methodology

The methodology to carry out this study consists of two major elements: (1) literature research and (2) case studies on large TEN-T projects. The relevant scientific literature can be divided into two groups:

- Literature on transport modelling and forecasting as well as on transport project assessment.
- Literature on governance of decision-making on large transport infrastructure projects, in particular focusing on European policy-making but also not neglecting the experience of national projects.

The eight to ten case studies on large TEN-T projects should be selected in agreement with the European Parliament. The criteria for the selection of case studies were agreed at the inception meeting and comprise:

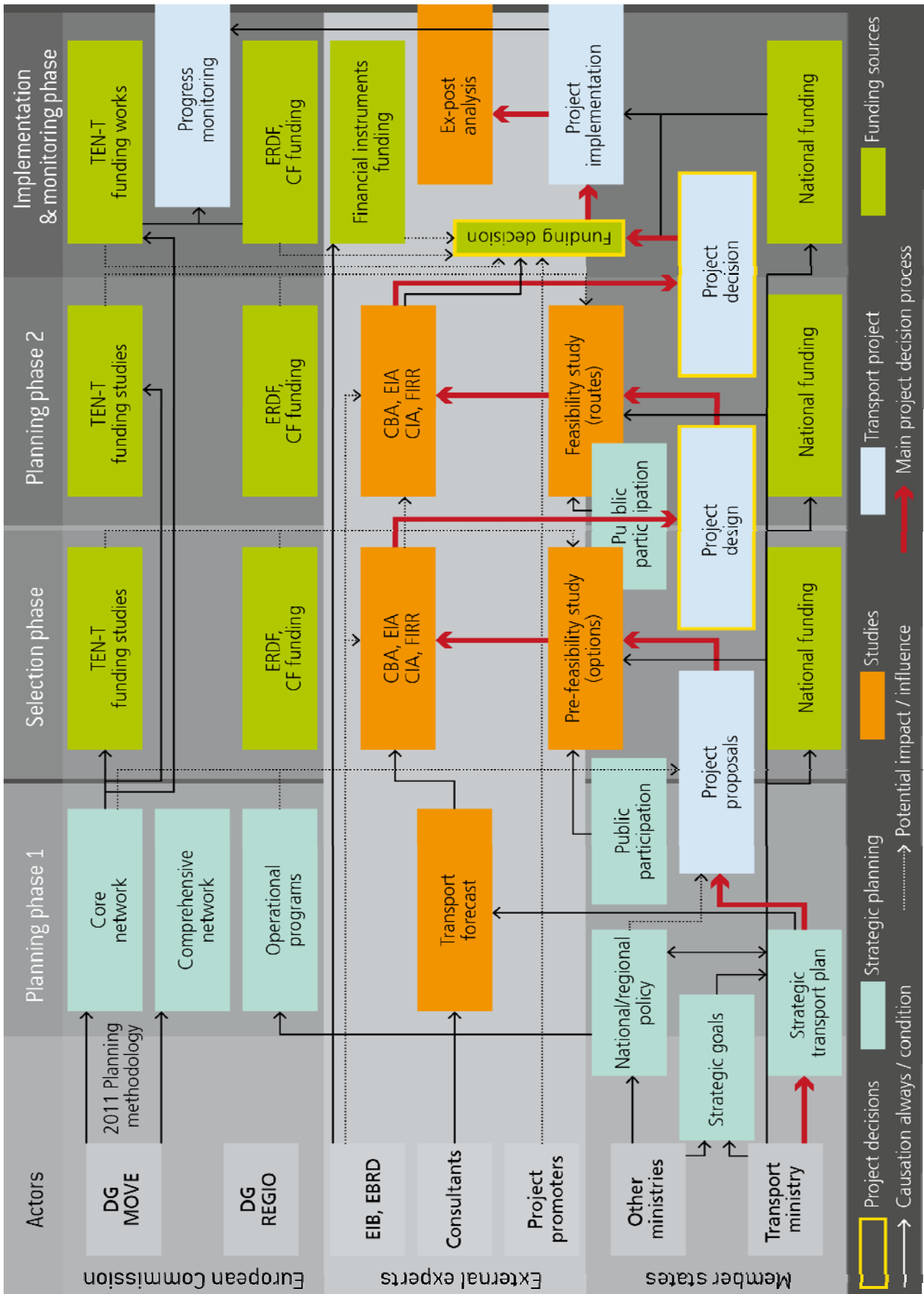
- Projects must be part of the core network as of today and the focus should be rather on single projects rather than corridors.
- Projects need to receive TEN-T co-funding, which could include both support for studies and/or works.
- Projects should have a significant total investment cost according to published sources (road > EUR 50 million, other modes > EUR 100 million).
- A modal balance should be kept, acknowledging that a large share of TEN-T are rail projects, i.e. including 4-6 rail projects out of 10 case studies would be acceptable.
- A regional balance should be kept, including the balance between EU15 / EU12 regions.
- It should be verified whether a project can be included that re-establishes a connection between EU15 and EU12 regions.
- Cases for which ex-post analysis will be feasible should be included.

Finally, ten case studies have been selected. Six out of the ten selected cases should allow for ex-post analysis. The four others belong to the largest cross-border projects that are currently planned in Europe and assessed as part of the TEN-T core network. The analysis of the case studies follows a template that was adhered to for each of the case studies, which are reported as annexes to this study. The focus of analysis is on the research questions concerning the assessment of projects related to investment costs, socio-economic cost-benefits including environmental benefits, environmental impact assessment, transport demand forecasts and updates of such studies over time. The latter is important for understanding the reasons of cost increases of the projects, since in the past cost overruns for many transport projects have been observed in the literature.

Analysis and findings

Figure 1 **Error! Reference source not found.** presents a scheme of a well-developed decision process for deciding on TEN-T project assessment, selection and funding. The scheme reveals the complexity of the decision process involving actors in Member States, at the European Commission and external experts including project promoters and project funders. Guidance is provided by highlighting the main project decision process (follow the red arrows). The scheme enables past and potential problems in the decision process to be identified. Problems in the decision process on TEN-T funding can be divided into problems of the strategic planning and of setting up and undertaking the ex-ante and ex-post studies, in particular socio-economic cost-benefit analysis (CBA), environmental analysis (EIA) either including or with separate climate impact analysis (CIA), and financial analysis (e.g. financial internal rate of return, FIRR).

Figure 1: Proposed decision-making process on TEN-T funding



Source: Fraunhofer-ISI

The problems related to strategic planning include the potential lack of a strategic transport plan both on the level of the Member States and the European Commission, or incomplete/flawed plans. The same issues may apply for the required definition of strategic goals or for the public participation in project definition (choice of broad options) and project design (choice of design options).

A basic problem arising from setting up and undertaking the ex-ante studies is the transport forecast. Though cases of underestimating future demand are reported, the opposite i.e. too optimistic forecasts are observed much more often. Better forecasts require reliable multi-modal network models, which in particular for the European level do not yet exist (although it is worth noting the difficulty inherent in constructing such a yearly Europe-wide model). Further, the impact of the economic crisis in 2008/2009 had repercussions on the EU economy and thus on transport demand and need to be taken into account in traffic forecasts underpinning current and future TEN-T co-funding decisions.

Socio-economic analysis, financial analysis, EIA and CIA all build on the transport forecast, but may include information from other impact areas, e.g. that not all (dis-) benefits are included in a CBA, which points to the fact that existing CBA guidelines of DG Regio could be further developed and enforced. EIA could be adjusted more closely to the planning stage and CIA made compulsory for large investments. Further problems, in particular relevant for the generation of large cost overruns, include the imprecise definition of projects and objectives to be achieved by the project. These may lead to fuzzy project design and then cause massive cost increases when plans may have to be changed during construction work. Methods to consider wider economic benefits, including European added value, are either not yet developed or are not applied to improve the selection of projects.

Sensitivity analysis and risk management approaches would help to overcome the previously described problems of transport forecasting and the assessment of costs and benefits. However, they are often not applied or risks are significantly underestimated, though there is currently a development of literature reporting about risk classifications and related cost mark-ups.

Transparency may depend on the funding structure being more difficult on the input side when private funding is involved. Transparency could improve planning and foster project success if transparent planning prevails from the start of decision-making rather than being executed at the end of the decision process or being completely neglected.

Ex-post studies may suffer from gaps existing with ex-ante studies, from interdependencies with other projects not being considered or unforeseen breaks of trends. Nevertheless, they are very important for generating a learning process for future project planning.

Though the previous problems in principle apply to any (multi-)national network planning, the decision to provide TEN-T co-funding involves additional problems, to be broadly summarized under the heading of conditionality issues. The conditions for co-funding were not precise enough and not strictly enforced, thus stimulating a fund-seeking behaviour of Member States. High co-funding rates for transport investments can be questioned because such investment should be widely based on commercial benefits.

Table 1 presents an overview on the ten case studies. The first five cases represent rail projects, the sixth a mixed rail-road project, the following two are road projects, the ninth covers the air mode and the tenth waterways. Total costs of the projects amount to between EUR 131 million and 12.4 billion. When available and applying reasonably low discount rates, the benefit-cost ratios are estimated between 1.75 and 6.54, available

payback periods lie between 7 and 20 years, available economic internal rates of return amount to between 5.3% and 9.4%. Two of the ex-post case studies, Malpensa airport and the West Coast Main Line (WCML) when compared to the 2003 plans, remained within +/- 5% deviation of the cost estimate. Problems of unclear or insufficient specification of the project were observed for the ex-post cases of the Betuwe Line, the first plan of WCML in 1996 and the tunnels on the SE40 expressway, the former two experiencing significant cost increases (sevenfold in the case of WCML) and the latter causing a debate about its usefulness three years after construction should have started. The Rail Baltica seems to face a similar risk, as the specification of what should actually be the project seems to be not fixed or still too imprecise, for taking sound implementation decisions. Two cases, the SE40 expressway and the A11 motorway, differ from what is reported at the European Commission TEN-T EA website, in a sense that they should have been completed and thus would have permitted our study for ex-post analysis, while in actual fact they still had not been completed. Some form of environmental impact assessment (EIA) is always carried out, though older projects planned during the 1990s or earlier reveal incomplete and insufficient EIAs, as opposed to the requirements of EIAs today. Climate Impact Assessment (CIA) in the form of life-cycle analysis of vehicles, fuels and infrastructures is never performed, neither is the estimation of CO₂ emissions from traffic activity included in more than 2 out of the 10 cases.

Transparency is an asset improving project assessment and performance as well as probably raising acceptance of the project. Positive examples would be the WCML plan of 2003 and the Fehmarn Belt Fixed Link, which provide the relevant studies publicly and with the intention of communicating with stakeholders. In general transparency seems to have improved for projects planned more recently, though not all achieve the level of transparency of the Fehmarn Belt Fixed Link.

Table 1: Overview of the results of the case studies

No	Selected TEN-T projects	Status	Cost EUR million	BCR / NPV / EIRR	EIA	CIA
1	Brenner base tunnel	planning	8 585 including risks	BCR: 1.9 (for 2.5% SDR)	Complete and updated (2008)	Missing
2	Betuwe Line	ex-post	4 705 (197 by TEN-T)	Payback per. 15-20 yr.	Simplified	Missing
3	Rail Baltica	planning	3 540 AECOM study	1.75 BCR 9.3% EIRR 0.05% FIRR	Aggregate environm. assessment	CO ₂ emission of traffic in environmental assessment
4	Slovenia - Hungary section of rail corridor V	ex-post (PP6 under construct.)	203.3	EIRR ex post: 9.4% (HU) 8.2% (SI)	Not available	Missing
5	West Coast Main Line (WCML)	ex-post	12 444	2.4 BCR 190/260 m£ NPV	Simplified	Missing
6	Fehmarn Belt Fixed Link	planning	5 500	2.6 BCR	Underway	Included in EIA
7	Tunnels on SE40 Expressway Sevilla-Huelva	con-struction, (ex-post)	239 (525) (24 by TEN-T EERP)	6.04 to 6.54 (6.36)	Yes, as of year 2000	Missing
8	A11 motorway Berlin-Poland	con-struction (ex-post)	131 (10 by TEN-T)	Missing	Complete for plan approval	Missing
9	Malpensa 2000 airport	ex-post	945 (27 by TEN-T)	Payback per. 7 yr., (CBA missing)	Incomplete, Focus noise, Updates	Missing
10	Seine- Scheldt waterway	planning	5 900	5.3% EIRR (France)	Completed 2005 (Flanders) & 2006 (France)	Missing

BCR = Benefit-cost ratio, NPV = net-present value, EIRR = Economic Internal Rate of Return, SDR = Social Rate of Discount, FIRR = financial internal rate of return

Source: different price bases, own elaboration

Though with the setting up of the TEN-T Executive Agency and the appointment of European coordinators for some of the TEN-T priority projects the decision-making and monitoring on EU co-funding for TEN-T projects has improved, there is still room for improvement. Relevant ex-ante studies are not stored with the project files and could thus not be made available at the EC, project monitoring and reporting seem to be inconsistent with the project status, data in the TENtec system seems to be inconsistent with national data, and thus we were not in a position to confirm that the conditionalities that apply for TEN-T co-funding are actually applied today.

Recommendations

(1) The methodologies for planning, forecasting and assessment need further development to effectively support decision-making for large transport projects in a multi-modal network context. This includes:

- Consideration of interdependency between the three basic pillars of transport planning: (i) strategic goal setting, (ii) systems analysis and optimal network design and (iii) comprehensive project analysis and assessment.
- Development of appropriate transport forecasting tools: the TRANSTOOLS model – developed for the European Commission – is still not mature and does not generate reliable data for multi-modal transport planning.
- Development of appropriate assessment instruments: assessment in most cases is based on partial cost-benefit analysis (CBA) and neglects important network effects. Feedbacks between transport, the economy and the environment are not captured and the European added value of large transport projects thus cannot be quantified.
- Environmental Impact Assessment (EIA) is obligatory. However, the scopes and the levels of detail differ. Definition of standards for the different phases of planning (pre-feasibility, feasibility, final project plan) is necessary. Furthermore, a clear definition of thresholds for intolerable environmental risks will be necessary to reduce planning costs, avoid problems of implementation and increase acceptance.
- Strategic Environmental Analysis (SEA) is obligatory. It should already be included in the phase of development of optimal network plans design and not only placed at the end of the process of developing an investment programme.
- Climate Impact Analysis (CIA) has up to the present not been obligatory. It is necessary, however, to check the compliance with EU climate goals. Beyond the carbon footprint of traffic activities the climate impacts of infrastructure provision and upstream/downstream processes should also be included.

(2) Planning and procurement processes in the Member States are different and may be biased by particular political interests. Moral hazard can occur if Member States seek EU funding. Therefore the EU co-funding mechanisms for transport projects need strict control and monitoring:

- It will be necessary to give narrower and clearer definitions for eligibility and for the quality of documents (as e.g. for the strategic transport plan and the assessment process for projects). Conditionality should be defined more precisely and the enforcement of conditions should be ensured.
- Funding rules should be harmonised. The European Commission has developed a proposal for setting up a Common Strategic Framework (CSF) for funding, including ERDF and CF but not TEN-T funding. This is certainly a step in the right direction for making the funding options and the control of funds allocation more transparent.
- Conditionality and proportionality should go hand-in-hand. The higher the proportion of EU co-funding provided to a transport project the more important should be the role EU conditions play in decision-making and the higher the requirements for ensuring their enforcement. A 10% EU co-funding, apart from generally binding requirements (e.g. provided by European legislation like the EIA directive), will have to respect the results of national assessments and decision criteria for issues under the responsibility of the Member States individual legislation, while higher co-

funding rates, in particular those above 50%, should make EU conditions the dominant decision base.

(3) Better information, coordination and participation are central issues:

- Better coordination and information is a pre-condition for a learning process, taking into account the good and bad practice experience of the past. The establishment of a central data office is recommended, containing the project fiches with links to all underlying documents (incl. documents from the Member States) and the monitoring results after project completion, including ex-post analysis on the project and corridor scale. This central data office should build on the TENtec information system operated by TEN-T EA that should be extended to store also the ex-ante studies and make them accessible to the public, at least in the form of meaningful summaries of the studies.
- Better participation of stakeholders is indispensable because of a growing resistance to large transport investment projects and will also improve the project decision base and thus the implementation decisions. Participation is a current process which must begin long before deciding on a project and should not stop after the formal approval of a project.

In general our understanding of the decision process on TEN-T co-funding is that it has significantly improved in the last five years. This can be developed further with the definition of the core network concept, the proposed update of the TEN-T guidelines from 2011 and the amendments to them requested by the European Parliament. Enforcement of the guidelines and respecting of the existing and newly established conditionalities, also taking into account the recommendations given in this study, seem to be the key elements for improving the TEN-T concept and making its co-funding most beneficial for the European Union. Transparency in decision-making seems an asset to this end, both for the project promoters who develop better performing, less risky and more widely accepted projects and also the European citizens who will get more beneficial projects in terms of economic and environmental benefits.

1. TEN-T HISTORY AND ASSESSMENT

KEY FINDINGS

- **Developing the TEN-T has been an issue of the European Union since its founding in 1957.** Until the mid 1980's progress on TEN-T was very limited. Thus the Treaty of Maastricht in 1992 established the TEN-T legally and initiated the process of developing TEN-T in a structured way. This process is still on-going today.
- The first guidelines for TEN-T development in 1996 foresaw the implementation of 14 European projects, the so-called Essen projects. The updated guidelines in 2004 suggested 30 priority corridors. Both concepts – **the 14 Essen projects as well as the 30 priority corridors - were largely influenced by national policies.**
- **The recent proposal for a comprehensive TEN-T revision of 2011 is a major attempt to centre TEN-T activities on a strategic European platform** and to complete the transition from a project- and then corridor-based perspective to a network concept grounded in a core and a comprehensive TEN-T network. The concept is supplemented by extended funding instruments, summarised in the Connecting Europe Facility (CEF).

1.1. Objectives and contents of the study

The development of Trans-European Networks (TEN) is a premier issue of European economic and social policy that dates back to the Treaty of Rome (1957) which included the adoption of a Common Transport Policy. It serves the goals of economic development, regional competitiveness, regional and social cohesion and environmental sustainability. With the establishment of the European Regional Development Fund (ERDF, 1975) European funding was made available, with funding options expanded in 1982 by a specific line of the EU budget dedicated to transport infrastructure of European interest. However, the implementation of this infrastructure remained very slow, even after 1982 (ECA 1993, Brömmelstroet/Nowak 2008). Therefore, the Treaty of Maastricht (1992) included an obligation for the European Commission and the European Parliament to prepare guidelines for the development of TEN and update them periodically. TEN comprise communications, electricity and transport infrastructure (TEN-T) networks. The first TEN-T guidelines were published in 1996, followed by updates in 2004 and 2011 (see section 1.3).

A number of major problems emerged in the planning, construction and financing of large projects already in the first phase of implementing TEN-T starting in 1996. Completion of the originally defined TEN-T fell behind the optimistic development plans. Several measures were taken to overcome these difficulties, including the establishment of the Trans-European Transport Network Executive Agency (TEN-T EA) designed to support the European Commission as well as Member State governments, project managers and promoters with the implementation processes; other examples include the appointment of TEN-T Priority Project / Corridor Coordinators or the development of additional financial instruments to overcome financial barriers. Notwithstanding the above, there remain indications of sub-optimal planning, procurement and implementation of TEN-T projects due to inherent inefficiencies. On the analytical side, there faulty project design may occur, non-integration into the TEN-T network design or an overly narrow impact analysis and evaluation. In particular, it has been questioned whether the (ex-ante) assessment of projects has taken sufficient account of strategic objectives such as regional integration,

environmental quality and control of the climate footprint. Beyond analytical weaknesses, the political processes of project definition, procurement and approval also need to be improved. The same holds for regimes of project finance including EU co-financing, with attention to a risk of creating opposite-of-intended incentives.

Against this background, the objective of the present study is to describe the assessment of transport projects, in particular large TEN-T projects, taking into account the following aspects in a sequence of analysis:

- History of TEN-T and TEN-T assessment
- Problems with TEN-T assessment
- Problems with TEN-T implementation
- Case Studies on TEN-T projects
- Recommendations for the development of assessment and procurement of large TEN-T projects.

1.2. Literature overview

Large transport infrastructure projects have been investigated in the literature with respect to four aspects:

- Statistical analysis of a large number of projects with respect to selected indicators, as for instance cost overruns.
- Analysis of the causes of success or failure for a limited number of projects.
- Elaboration of methodological progress to improve the assessment of large projects.
- Developing alternative schemes for the planning process and procurement.

The following is a brief description of selected approaches for the above aspects.

1.2.1. Statistical analysis with respect to selected indicators

Flyvbjerg, Bruzelius and Rothengatter (2003, p 15) refer to four studies which have rigorously compared the forecast with actual costs of transport infrastructure projects in Sweden, the US, the UK and Denmark. The Danish study from the University of Aalborg was the largest one, comprising 258 projects from 20 countries worth approximately EUR 70 billion (in 1995 prices), and allows for a statistical analysis with respect to cost overruns. The methodology and results of this study have been published by Flyvbjerg with other authors in a number of research papers, e.g. Flyvbjerg, Holm and Buhl, (2002). The main findings are:

- The costs were underestimated for 90% of the projects.
- For rail, actual costs were on average 45% higher than estimated.
- For road, actual costs were on average 20% higher than estimated.
- For fixed links (tunnels, bridges) the cost overruns were on average 34 %.
- Cost underestimation and overrun have not decreased over time, i.e. no learning effect was observed.

1.2.2. Analysis of the causes of success or failure

Most studies on large transport infrastructure projects address this topic. The number of projects analysed is in general so small that statistical approaches are not appropriate (though Flyvberg (2009) provides some statistical figures). Still, it has been possible to analyse a number of indicators of success or failure. The Volvo Research and Educational Foundations (VREF) have sponsored a large study on decision-making in the planning, appraisal and evaluation of mega urban transport projects and their impacts. The research includes 33 projects worldwide and was carried out by a consortium led by the OMEGA Centre of the Bartlett School, UK, started in 2006 and completed in 2011 (OMEGA 2012). The research approach included – beyond collection and evaluation of quantitative data:

- Overviews on country-based historical and contemporary main policy, planning and funding frameworks,
- Description of the objectives and expectations of the stakeholders, which may often be conflicting,
- Analysis of selected large projects by a “narrative” method,
- Hypothesis research based on interviews (“Pre-hypothesis” approach using indirect questioning techniques).

The primary goal of this research was to structure the complex decision environment to arrive at a deeper understanding of factors which result in the success or failure of large projects. Researchers started with the hypothesis that the focus on cost overruns was too narrow. Aspects of social and regional balance or environmental problems often emerged in the course of planning or even construction on large projects and led to higher costs. While the latter can be considered as a failure from a narrow economic point of view, they may contribute to a project design which in the end meets the societal goals better than had been planned at the outset.

The OMEGA Centre (2010) prepared a further study along the above lines for the Institution of Civil Engineers and the Actuarial Profession to improve their methodology for Risk Analysis and Management for Projects (RAMP). In this study, aspects which are often neglected in financial evaluations of large projects such as social and environmental risk, engagement of stakeholders throughout the project life cycle or stakeholder participation were in the forefront of analysis and resulting recommendations.

In contrast to the very general approach of the OMEGA research, there have been a number of project-related reports on the success and failure of large investments. SNCF has prepared a detailed ex-post analysis for all large railway projects, e.g. the TGV Nord (Paris-Lille; *Bilan LOTI de la LGV Nord*, 2005), or the TGV South (Paris-Marseille; *Bilan LOTI de la LGV Méditerranée*, 2007). These ex-post studies focus on the comparison of forecasting data (demand estimation) and of cost data (cost estimation) and provide a good basis for demonstrating the reasons of success and failure. For instance, the forecasting for the traffic volumes of the TGV Nord was based on the assumption that a high-speed link exists between Lille and London St. Pancras. But while the TGV Nord link was opened in 1993, the HSR link to London only opened in 2007. Thus, the full potential for passenger rail traffic could not be harnessed by a high standard Paris-London service for well over a decade.

A large number of studies have meanwhile addressed problems concerning these contrasting prototypes (OMEGA research: exploration of the complex decision environment;

SNCF: narrow ex-post comparison of forecast and cost figures). It follows from the literature review that elements which have partly been neglected in conventional planning and procurement so far include:

- Insufficient assessment methodology with respect to
 - Integration of long-term strategic goals
 - Systems analysis and choice of best network configuration
 - Application of comparable standards for EIA, SEA and CIA.

- Adjustment of the planning and procurement process with respect to
 - Incentives for transparency, truth-telling and adaptivity
 - Better coherence between planning and financing.

Stricter control and monitoring for EU co-funded projects with respect to

- Eligibility and conditionality
 - Harmonisation of funding regulations.
-
- Setting up a central knowledge base for project success
 - Integration of stakeholder participation.

Recommendations for improvements of project appraisal and procurement along these lines will be given in chapter 5 based on literature findings and the analysis of past EU funding experience.

1.3. TEN-T History

1.3.1. TEN and TINA networks of the 1990s

In 1990 the Portuguese Presidency came forward with the proposal to establish a European infrastructure agency for co-ordinating national plans and making network infrastructures interoperable (see Turró 1999, Szimba et al. 2004). The European Commission (1990) elaborated a report entitled „Towards Trans-European Networks“, which included a concept for a European high-speed rail network. While the European infrastructure agency was not considered in the further political process, the idea of Trans-European Networks (TEN) was taken up and extended to include telecommunications, energy and transport networks (TEN-T) and became a constitutive element of the 1992 Maastricht Treaty. The TEN were regarded as a key element for fostering economic and social integration, the free movement of persons and goods, and balanced regional development in the Union.

Article 129 of the Treaty called for a series of guidelines covering the objectives, priorities and broad orientations of the TEN, to implement any measures necessary to ensure the inter-operability of the networks and support the financial effort of Member States for projects of common interest. The first guidelines for TEN-T were published in 1996 as Decision No 1692/96/EC of the European Parliament and the Council (European Union 1996). TEN-T were subdivided into 9 sub-networks for air, road, rail and maritime transport and the supporting telecommunication systems (ITS). The first concept had been elaborated by a high-level expert group led by Henning Christophersen, the former Vice-President of the European Commission. The “Christophersen Group” proposed 14 projects which were decided by the Council summit in Essen 1994 and formed the backbone of the

guidelines 1996 ("Essen Projects"). A rough estimate of the budget needed for implementation of the Essen projects amounted to about EUR 96 billion. EU co-financing of up to 10% was decided on (with a budget limit of EUR 1.42 billion), together with financial assistance by the EIB and EIF. The cohesion countries could receive additional funding from the Structural Development Funds (ERDF) and the Cohesion Funds (CF) so that transport investments in Ireland, Greece, Portugal and Spain could receive substantial financial support.

Parallel to the development of the TEN, the European Commission supported a common initiative with Eastern neighbouring countries to extend the networks beyond the borders of the EU15. So-called "Pan-European transport conferences" were held in Prague (1992), Crete and Helsinki (1994). The outcome was the definition of 10 traffic corridors between Western, Central and Eastern Europe, which extended the network of the Trans-European infrastructure to the forthcoming accession countries. A common initiative for analysing the needs of future transport infrastructure in the accession countries was launched as the 1995 "Transport Infrastructure Needs Assessment" (TINA) based in Vienna. The TINA-transport infrastructure network includes the "Helsinki corridors", which were defined in 1997, and consists of a backbone network and an extended network which complements the functionality of the backbone.

A total of about EUR 92 billion in investment was considered as essential to complete the TINA backbone network over 1998-2015. The European Commission established the ISPA (Financial Instrument for Structural Policy Assistance for Accession) special funding instrument, equipped with EUR 1 billion per year of which 50 % could be spent on transport. Further funding could be received from the World Bank, the EBRD (European Bank for Reconstruction and Development) or the EIB (European Investment Bank), and have altogether provided more than EUR 4 billion in loans for transport investment projects in Central and Eastern Europe.

1.3.2. Transport White Paper 2001 and TEN-T of the 2000s

The European Commission 2001 White Paper (European Commission 2001) emphasised the importance of completing the priority projects, expanding their list by a further eight projects, as well as adapting the funding rules. The White Paper also announced a proposal for a revision of the guidelines for the development of the TEN, which – together with the extended list of priority projects – was officially submitted to the European Parliament and the Council (COM/2001/544 final). Further steps towards a revision of the guidelines for the TEN were brought forward by:

- the High-Level Group ("van Miert Group") on the Trans-European Transport Network, whose objective was to identify the priority projects of the TEN-T up to 2020 on the basis of proposals from Member States and the acceding countries (HLG, 2003),
- the launching of a project on "scenarios, traffic forecasts and analysis of corridors on the Trans-European network", called TEN-STAC (NEA et al. 2004),
- the formation of a TEN-T Committee acting as a representation of Member States and acceding countries,
- and the establishment of an interdisciplinary task force at the European Commission.

In October 2003, the European Commission issued a proposal for a decision of the European Parliament and of the Council amending the guidelines for the development of the trans-European transport network (COM(2003 564 final)). This was followed by the decision of the European Parliament and of the Council No 884/2004/EC amending the decision No. 1692/96/EC on Community Guidelines for the development of a Trans-European Transport Network.

The list of priority projects included the TINA projects as a result of EU enlargement and comprised the extended list of 2001 priority projects (see COM/2001/544 final), together with the recommendations by the high-level group on the TEN-T and reactions received from the Member States after the publication of the high-level group's report. The projects were organised in a total of 30 TEN-T corridors. Out of the 30 corridors 18 concern the improvement of the railway network, three are road projects, four are combined rail/road projects and two aim to improve inland waterways. Furthermore, the Milan Malpensa airport project was again included in the list; the Galileo satellite system and the Motorways of the Sea completed it. The TEN-T as a network originally planned up to the year 2020 is described in a brochure of the European Commission (2005).

The overall budget for the TEN-T was estimated at about EUR 600 billion while the priority corridors would need about EUR 225 billion (later revised to EUR 252 billion) including EUR 112 billion for completing the Essen projects (11 out of 14 projects had hitherto not been completed). The following financial instruments were developed:

- TEN-T funding for up to 50% of planning costs and up to 10% of construction costs, in exceptional cases up to 20%.
- Overall TEN-T budget for 2007-13 (ultimately set at EUR 8 billion).
- Structural development (ERDF) and cohesion funds
- ISPA funds
- EIB loans
- Member State financing.

1.3.3. Priority Projects, Core Network and European TEN-T Coordinators

The structure of the planned 2007-13 TEN-T funding is shown in Table 2. The share of EU grants is about 15% of the total investment budget. Grants and loans amount to about 30%. This implies that the biggest part of funding (70%) has to be provided by the budgets of the Member States, possibly extended by public private partnerships (PPP) and user-financing (e.g. the charging of heavy goods vehicles on motorways and highways where the revenues can be used for transport investment). The "user-pays" principle has been strongly endorsed in the White Paper on common transport policy (European Commission 2001), as it has been foreseen that the potential of national budget financing will not increase in the future. As an example, Directive 2006/38/EC (amended by 2011/76/EU) allows Member States to increase the charges by 25% in mountainous areas and earmarks the revenues for transport infrastructure improvements.

Table 2: Financing the priority TEN-T network, 1996–2013

TEN-T Priority projects	1993/96–1999 EU 15	2000–2006 EU 25	2007–2013 EU 27
Cost (EUR billion)			
TEN-T 30	32.65	93.7	154
- EU 10 / EU 12 Member States			16
- EU 15 Member States			138
Community / Union contribution (EUR billion)			
TEN-T Programme	1.35	2.80	5.4
Cohesion Fund	3.83	7.0	12.3
ERDF	1.46	4.81	4.7
EIB Loans and guarantees	9.78	16.1	25
Total Community / Union contribution (EUR billion)			
Grants	6.64 (20.3 %)	14.61 (15.6 %)	22.4 (14.5 %)
Grants and loans	16.42 (50.3 %)	30.71 (32.8 %)	47.4 (30.8 %)
Other resources (national)	16.32 (49.7 %)	63 (67.2 %)	106.6 (69.2 %)

Source: European Commission 2010c

As the implementation of the Essen projects proved sluggish, the European Commission established two institutional innovations to accelerate the process: the European Coordinators for selected corridors and the TEN-T EA (Executive Agency). Presently, there are nine Coordinators for priority corridors no 1, 3, 6, 17, 18, 21, 22, 27, 30, and ERTMS. Their task has been in particular to identify problems, especially with the cross-border sections of the projects, and to develop solutions together with the national and regional authorities concerned.

The TEN-T EA was established in 2006 and has been in charge of the technical and financial implementation of the TEN-T programme, which includes altogether about 350 single projects. The main tasks of TEN-T EA are to:

- provide the European Commission with assistance in the programming, selection and monitoring of projects;
- coordinate with other financial instruments (EIB, ERDF, Cohesion Funds);
- provide technical assistance with financial engineering to project promoters;
- administer the budget of the TEN-T programme.

In accordance with the TEN-T Regulation (Art. 16), the programme has to undergo regular evaluations. A first mid-term report evaluated the methods and procedures for granting financial aid and formulated overall conclusions and recommendations on the further TEN-T programme at the end of 2010. Progress was controlled by the European Court of Auditors (e.g. ECA 2010).

In preparation for the next revision of the guidelines, foreseen for 2011, and the following 2014-2020 budget period and Multiannual Financial Framework, the European Commission

organised a broad review of TEN-T policy. This included the recommendations of TEN-T Coordinators (2009) as well as a TEN-T Green Paper (COM (2009) 44 final). The European Commission established six expert groups: methodological issues; integration of transport and TEN-T policy; connection with third countries; financing issues; and legal issues. The guiding principle was to move from a project orientation (Essen projects) followed by the corridor orientation (van Miert corridors, TEN-T 2004) to a network orientation. The expert groups agreed with the European Commission to suggest a classification into:

- a Core Network, comprising all nodes and links of highest European importance, and
- a Comprehensive Network comprising the whole TEN-T of 2004 together with additional missing links.

Expert Group 1 (on methodology) concluded that this approach would have consequences for the assessment of TEN-T. A narrow project-based CBA evaluation would not be sufficient to capture the network effects and secondary benefits of large projects or project combinations (packages). Additional instruments of evaluation such as Spatial General Equilibrium Models or System Dynamic models would have to be further developed, and until these methods have not been tested, system-based multi-criteria approaches including an integrated CBA could be applied. The main outcome of applying system-based evaluation instruments is that the "European added value" of network configurations can be more precisely defined and quantitatively proven.

The European Commission presented the proposal for TEN-T revision and new core network corridors in October 2011. While the projects defined in the 2004 revision have been included, they have been re-arranged in order to form a revised corridor concept which is integrated into the core network paradigm.

The overall costs for developing the transport network have been estimated at EUR 500 billion until 2020 (European Commission, 2011c). This includes 50% of the costs of completing the TEN-T Core Network (EUR 250 billion) which is scheduled for completion by 2030 at a total estimated cost of EUR 500 (European Commission, 2011). To address the hitherto encountered financial barriers, the European Commission has proposed a new financial instrument, the Connecting Europe Facility (CEF) of EUR 31.7 billion for 2014-2020. EUR 10 billion will have been earmarked from the Cohesion Funds for the CEF, and intended to be spent on network improvement in cohesion and accession countries. The European Commission expects a substantial multiplier effect through PPPs, EIB, ERDF and the budgets of Member States in an order of magnitude of 1:15 to 1:20 as needed to finance the programme until 2020 and later. TEN-T EA will remain responsible for technical and administrative assistance, control and monitoring.

1.4. TEN-T Funding principles and their incentive impacts

The development of the TEN-T network since 1996 has shown that financial constraints are a major barrier for the implementation of planned projects. The present debate on the volume of the EU budget for 2014-2020 and the future challenges of budget consolidation by Member States do not suggest a lessening of the constraints. This leads to a realistic assessment of the existing financial instruments and the possibilities of bolstering them through private capital. On the one hand, the positive effects of European added value, such as closing network gaps in border areas deserve to be highlighted. On the other hand, the question of whether EU financial support has set the right incentives for the most appropriate design of projects and avoidance of over-investment also needs to be addressed.

In the following, the technical aspects of EU funding instruments are briefly described (section 1.4.1) - for a complete overview of financial instruments, see the European Parliament Study on "Financing Instruments for the EU's Transport Infrastructure" (CE Delft et al., 2012). This chapter will focus on raising additional private capital and the incentive impacts of EU funding (sections 1.4.1 and 1.4.2).

1.4.1. Funding instruments and their contributions

Aggregating the figures given by Panagopoulos and referred to in CE et al. (2012) results in a 73% share for national financing, and EU co-financing of 27%. The latter consists of

- the TEN-T Fund (2%)
- the Structural and Cohesion Fund (ERDF/CF) (11%), and
- EIB co-financing (14%).

The overall financial contribution of the EU to TEN-T infrastructure in 2007-2013 was EUR 105 billion (EUR 8/44/53 billion from the TEN-T fund/ERDF-CF Fund/EIB co-finance).

(a) Traditional funding

Grants given by TEN-T funds and ERDF/CF are the main sources of EU funding. While the policy framework for allocation of funds is set by DG MOVE, technical management is performed by the TEN-T EA. The maximum TEN-T co-funding rates are 50% for studies/plans, 10-30% for works, 50% for ERTMS and 20% for traffic management systems. The maximum rate for ERDF/CF co-funding is 85%. 73% of the projects were 10-30% co-financed by the investment budget, while 27% of the projects enjoyed co-financing up to 50%.

The majority of EIB co-financing consists of commercial long-term loans which are in general given subject to a project appraisal of the bank. Ex ante appraisal is verified by ex-post analysis of the project success. The maximum co-funding rate is normally 50%; in exceptional cases, it may reach 75%.

(b) Connecting Europe Facility (CEF)

The CEF has been developed as a main financial instrument for the forthcoming 2014-2020 financing period to support the investment programmes under the proposed TEN-T guidelines (COM (2011)650/2). A total budget of EUR 31.7 billion has been foreseen, with EUR 10 billion earmarked from the Cohesion Fund. This would mean a considerable increase compared with the previous budgetary period which allocated only EUR 8 billion to the TEN-T programme. It is hoped that the fund will create significant leverage and stimulate further public and private funding.

(c) "Innovative" instruments

The European Commission has considered four financial instruments as innovative:

- (1) The Structured Finance Facility (SFF): established in 2001 for support of priority projects with higher risk profile instruments - with EIB loans given to Member States.
- (2) The Loan Guarantee Instrument for TEN-T Network (LGTT): established in 2008 to attract private sector capital. Provides risk guarantee in particular for the first years after project opening for revenue-generating projects.
- (3) The EU Project Bonds: this initiative, started with a pilot phase in 2012-13, will try to attract private capital from institutional investors like insurance companies and

pension funds. Project Bonds are intended to increase the credit rating to at least A- level. As with the CEF, a multiplier effect of 15-20 is expected.

- (4) The Marguerite Fund: an equity fund established in 2008 by six founders including the EIB and KfW. Used for TEN-E (energy, e.g. renewables) until now, in principle suitable for TEN-T funding.

These instruments have contributed about EUR 5 billion to the TEN-T programme over 2007-2013, with the lion's share of funding from the SFF with a volume of EUR 3.75 billion.

(d) Concession finance and PPP

Motorways are managed and financed by concession companies in several EU countries according to different organisation principles. Concession companies finance investments through loans, equity capital and the capital of concessionaries. Public companies in countries with a high investment grade enjoy similar credit conditions to the Owner State. Re-financing is done through user charges or shadow charges paid by the state.

As soon as the private financing base is not sufficient for realising a project and state grants have to be added, the resulting organisation of management and finance is called a public-private partnership (PPP). The project is run by a private concessionary while the public sector can participate in the form of grants, interest guarantees or various types of risk-sharing. Several PPPs have been financial failures because of overly optimistic expectations included in the contracts (e.g. M1 motorway, Hungary), while others have been criticised by the auditing authority because of the possibility of making supernormal profits (e.g. A8 and A5 motorways, Germany). Drawing up contracts to include both a guarantee of fair risk-sharing by the "public" side, and minimal probability of supernormal profits has continued to be a challenge.

1.4.2. Elements advancing and countering TEN-T objectives

The leading principle in providing financial assistance by the above instruments is to generate European added value through connecting networks in border areas, providing efficient modal interchange and removing bottlenecks along transeuropean corridors. All this should improve competitiveness and help to achieve the sustainability goals as formulated in the 2011 White Paper. Transport investment projects which foster these goals are not necessarily financially viable and can only be implemented with support from public financing. If Member State budgets cannot meet these tasks (e.g. in the case of accession countries) or if Member States do not show sufficient interest in pursuing particular issues (e.g. in the case of cross-border projects), EU co-financing can serve as stimulus for advancing projects with high European, but limited national, value.

Where the approval of funding is subject to the principles of conditionality, EU financial instruments can work as a driving incentive, i.e. encouraging the Member States to set up strategic transportation plans which clearly show the long-term net benefits (economic, ecological and social) and European added value as well as the necessity of the given project in this context. This principle helps to avoid purely instinctive project promotion and fund-seeking by narrow interest or stakeholder groups.

While the idea of EU co-funding is to support the implementation of the transeuropean networks according to the guidelines, the practice of fund allocation also can have a contrary impact. In practice, TEN-T funding represents only 7.5% of the overall EU funding for transport which is dominated by the ERDF and CF. The objectives of these two are different from TEN-T funding. For the 2007-13 programming period the objectives have been "Convergence", "Regional competitiveness and employment" and "European territorial

cooperation" (EC Regulation 2006/1083). This means that environmental objectives were less important for ERDF and CF, while the TEN-T objective of promoting rail and inland waterways played a minor role in allocation of funds. As a consequence, most ERDF and CF funding has gone to road investments (52%) while only 30% has been allocated to rail and 1% to inland waterways. EIB funding follows a similar line, with 49% for road and air, and 22% for rail and intermodal transport. Clearly, the eligibility criteria for bank finance have favoured environmentally less efficient transport modes - in clear contrast to the TEN-T objectives.

With the maximum co-funding rate of CF and ERDF at 85%, these funding instruments have been most relevant for accession countries which fulfil the eligibility criteria. High rates of co-financing may lead to fund-seeking behaviour of the recipients, as demonstrated by past experience with vertical finance allocation schemes. Once planning responsibility is dissociated from financial responsibility, the beneficiaries tend to tailor their projects in a way to enable maximum co-financing. This can lead to faulty, or over-design of projects (see Flyvbjerg et al, 2003).

As long as the conditionality of preparing a strategic transportation plan was not rigorously checked by the European Commission, the Member States could apply for project funding using very approximate assessment methods in which the economic viability had not been carefully investigated. This created incentives to submit project plans which were politically motivated and favoured political goals rather than network functionality. The European Commission has reacted by strengthening conditionality requirements - also in countries lacking a tradition of transport master planning (see section 3.2).

For revenue-generating projects, financial support from EU funds is only given for the investment costs minus the net revenues (Article 55(2) of Regulation 2006/1083). This could encourage countries to manipulate the project assessment to show high benefit/cost ratios but low financial revenues, so as to maximise the chance of EU co-funding and increase the rate of EU funding simultaneously¹.

1.5. TEN-T assessment: role of Member States

The Member States decide on their choice of assessment method, implementation of the preparation steps and carrying out project assessment required for Community funding. The European Commission provides assistance through guidelines (e.g. DG Regio Guide for CBA, European Commission 2008) and advising countries (in the first instance: former accession countries) on preparing the transport planning and project documents to serve as a sound base for the funding decisions to be taken. Since 2005 this advisory role has been assigned to JASPERS (Joint Assistance to Support Projects in European Regions).

Member States have used a wide range of assessment approaches. Most of them apply CBA to assess road infrastructure projects. However, a 2005 survey showed that in EU-10 countries the assessment was mainly carried out for projects targeting EU funding (HEATCO 2005). Among national assessment methods for transport infrastructure investments, some have assumed a standardised form as instruments for the systematic prioritisation of projects, as performed by the respective national Ministry.

The following two boxes list selected international and national sources. With respect to international sources (Box 1) the DG REGIO Guide for CBA (European Commission 2008)

¹ This follows the principle of the "selection of financial lemons" as described by 2001 Nobel Prize Laureate G. Akerlof (1970).

gives the most detailed guidelines for preparing a CBA analysis on the project scale. The UNECE (2003) document focuses on MCA and provides an alternative approach to the assessment task. Box 2 lists standardised assessment procedures of selected Member States.

Box 1: Transport Infrastructure Assessment - international approaches

International Sources for Transport Infrastructure Assessment

- Transport Infrastructure Needs Assessment (TINA): Socio-economic cost-benefit analysis, in the context of project appraisals for developing a Trans-European Transport Network in Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia, Vienna, October 1999.
- United Nations Economic Commission for Europe (UNECE): Cost-Benefit Analysis of Transport Infrastructure Projects: New York and Geneva, 2003.
- European Commission, DG Regional Policy: Guide to cost-benefit analysis of investment projects - Structural Funds, Cohesion Fund and Instrument for Pre-Accession, 2008.
- European Commission, European Investment Bank: Railway Project Appraisal Guidelines RAILPAG, (of specific interest is the stakeholder analysis (SE matrix)), 2005.
- International Transport Forum (ITF): Improving the Practice of Cost Benefit Analysis in Transport, Discussion Paper No. 2011-1, Summary and Conclusions of the Round Table on Improving the Practice of Cost Benefit Analysis in Transport (21-22 October 2010, Queretaro, Mexico), January 2011.
- European Conference of Ministers of Transport (ECMT), Committee of Deputies: Assessing the Benefits of Transport, Pre-publication version, 13 Nov 2000.
- European Commission, DG Regional Policy: Guidance on the Methodology for carrying out Cost-Benefit Analysis, The New Programming Period 2007-2013, Working Document No.4, August 2006.
- R. Roy: Lost and Found: The community component of the economic return on the investment in PBKAL, ECIS report, November 1995.
- M. Florio: Cost-benefit analysis of infrastructure projects in an enlarged European Union: an incentive-oriented approach, working paper n. 13, Università degli Studi di Milano, 2003.
- European Commission, Europe Aid Co-operation Office, Joint Evaluation Unit: Evaluation methods for the European Union's external assistance, guidelines for project and programme evaluation, volume 3, Luxembourg, 2006.

Source: own elaboration

Box 2: National Examples for Transport Infrastructure Assessment**National Examples for Transport Infrastructure Assessment****France:**

- CBA approach based on Boiteux Report (2001) with a detailed standardised monetary evaluation of project impacts
- Extended after 2007 (Grenelle Environment Conference) to MCA scheme according to Brundtland Report (economic, social, environmental criteria)
- Developed further in the context of SNIT (Schéma National des Infrastructures de Transports, 2010)
- Revision prepared by Centre d'Analyse Stratégique, an advisory institution to the French Prime Minister, "Quinet Working Group".

United Kingdom:

- Series of modelling and appraisal tools developed for the DfT, national transport model
- Well developed and standardised for road investments; detailed guidance for transport analysis (WebTAG)
- CBA as a basic appraisal component
- INCA – Incident cost-benefit assessment (spreadsheet based)
- TUBA – transport user benefit appraisal; current versions on WebTAG.

Germany:

- Standardised macro-economic evaluation; last release 2003
- Multi-modal transport forecast
- Central appraisal element: CBA, standardised for 9 benefit criteria and 16 sub-criteria
- Project-oriented partial analysis
- Applied to all federal transport investments, altogether about 2000
- Supplemented by environmental risk analysis and spatial impact analysis (no standardised aggregation of CBA and MCA elements)
- Revision being prepared for 2015, integration of SEA.

Czech Republic:

- Preparation of strategic transport plan for the mid-term with a long-term outlook
- Multi-modal transport forecast
- MCA for assessment of network configurations
- Integration of SEA foreseen
- CBA enriched by environmental criteria
- Multi-modal development plans
- Financial analysis and forecast accompanying the investment programme.

Source: own elaboration

1.6. Selection of case studies

The analysis of case studies is intended to give concrete examples of good and poor practices for planning, procurement and finance of large transport infrastructure projects. We have drawn up the below-listed selection criteria to short-list the case studies for the present study. After discussion and in agreement with the responsible services of the European Parliament, the list was narrowed down to 10 representative case studies, which as a whole set fulfilled the selection criteria:

- Projects must be part of the core network as of today.
- Focus should be rather on single projects not corridors.
- Projects need to receive TEN-T funding.
- Projects should have a significant total cost (road > EUR 50 million, other modes > EUR 100 million). This was assessed by checking the information available at TEN-T EA website (http://tentea.ec.europa.eu/en/ten-t_projects/).
- A regional balance should be kept, including a balance between EU15 / EU12.
- A modal balance should be kept, acknowledging that a large share of TEN-T are rail projects, i.e. including 4-6 rail projects out of 10 case studies would be acceptable.
- Cases for which ex-post analysis will be feasible should be included.
- It should be verified whether a project can be included that re-establishes a connection between EU15 and EU12 regions.

The final selection of the 10 case studies analysed in detail in this study is presented in Table 3.

Table 3: Selected case studies

No	Selected TEN-T Projects	Mode	Area / Country	Current Project Phase
1	Brenner base tunnel	rail	EU15 AT/IT	planning
2	Betuwe line	rail	EU15 NL/DE	ex-post
3	Rail Baltica	rail	EU12 PL/LT/LV/ES/FI	planning
4	Slovenia - Hungary section of rail corridor V	rail	EU12 SL/HU	ex-post
5	West Coast Main Line (WCML)	rail	EU15 UK	ex-post
6	Fehmarn Belt Fixed Link	rail/road	EU15 DK/DE	planning
7	SE40 Expressway Sevilla-Huelva	road	EU15 ES	construction, ex-post
8	A11 motorway Berlin-Poland	road	EU15/EU12 DE/(PL)	construction, ex-post
9	Malpensa airport	air	EU15 IT	ex-post
10	Seine- Scheldt waterway	waterway	EU15 FR/BE	planning

Source: own elaboration

2. PROBLEMS WITH TEN-T ASSESSMENT

KEY FINDINGS

- **Scientific research and professional application have developed a rich literature on transport project assessment** using CBA, MCA and other methodologies. Standardised methods can be found to a larger extent for project assessment on national levels, nevertheless there is an increasing literature on supra-national assessments.
- **Transport network models are applied for forecasting the impacts of new infrastructures on transport activities.** Their quantitative results feed into the various impact measurement and assessment schemes, often following standardised approaches and guidelines. Such guidelines are available on both the level of selected Member States and on European level.
- Evaluation of transport impacts and environmental impacts, though there prevails some disagreement about monetisation possibilities, follow a broad consensus concerning their need to be considered. However, **discussion about measuring secondary economic benefits is on-going. The same holds for a standardised definition and measurement of the European added value** which would be important for co-funding decisions.
- **Problems with the assessment of TEN-T projects can be identified** in the lack of an operational European transport model delivering reliable results, in the diversity of national assessment approaches that might also generate conflicting results and the lack of assessment capabilities in some smaller and/or New Member States.
- The assessment methods predominantly applied to transport projects are **partial approaches**, neglecting network interdependencies and dynamic feedbacks with the economy (secondary impacts). An extension of methods is necessary to capture long-run feedbacks between transport and the economy and the **"European added value"** of large projects.
- **In general assessment methods are applied ex-ante but not for ex-post control.** A learning process driven by systematic evaluation of experiences made with large transport infrastructure investments is missing.

This section first briefly describes the rationale and approaches of transport infrastructure assessments. This is followed by an overview on the assessment of past and recent TEN-T network concepts and an overview on relevant planning and assessment guidelines. Finally, the potential and useful extension of transport (network) impact assessments is discussed.

2.1. Rationale of project assessment approaches

Impact assessment schemes have been developed for the European Commission for about 20 years. This first group of schemes comprises general guidelines, as for instance the Impact Assessment Guidelines (SEC (2009)92, European Commission 2009b), the Guidance on the Methodology for Carrying Out Cost-Benefit Analysis (Working Document No. 4 of the European Commission for the Programming Period 2007-2013) or the Guide to

Cost-Benefit Analysis of Investment Projects developed for DG Regio by TRT et al. (2008). Secondly, specific guides have been developed for assessing transport infrastructure projects, as for instance the Guide to Cost-Benefit and Multi-Criteria Analysis for New Road Construction (DOC EURET/385/94.final report, 1994), the study on Socio-economic and Spatial Impacts of Transport (EUNET, 1999) or pilot studies for evaluating the relevant impacts (including external costs) of transport infrastructure investments, as for instance UNITE (2002) or HEATCO (2005).

One can categorise the assessment approaches based on the above documents and a rich background literature on theory and applications as follows in Table 4:

Table 4: Overview on assessment methods

	Principle	Advantage	Limits
Standard methods Socio-ec.	Broad literature foundation Wide applications in public and private decision support	Clear methodology Clear guidance Many options for comparison and control	Applied to projects and not to networks or systems Partial analysis, neglecting feedbacks
Cost-benefit analysis (CBA)	All private and social impacts included, evaluated in monetary terms Aggregation by business-like indic.	Standardised implementation clear indication of economic viability Comparability of project results	Difficulties with non-monetary impacts, e.g. environment, climate impacts, spatial development
Cost-efficiency analysis (CEA)	Index of efficiency to be constructed and relate to investment costs	Less information required than for CBA Easy to perform	No indication of economic viability Problem of defining efficiency indicator
Multi-criteria analysis (MCA)	All objectives Impact measurement Transformation into common scale Mapping into utility indices	Inclusion of all impacts Based on decision theory Sound ranking of alternatives	Subjective elements of decision maker or analyst No indication of economic viability Many options for implementation
Financial impact assessment	Financial result for management or concession company Business indicator (ROCE, EIRR)	Indication of private business success Suitability for PPP	No social impacts included Partial measure
Environmental assessment	Assessment of all environmental impacts	Quantification of environmental risk on people and nature	Partial evaluation for affected region or country
Environmental impact analysis (EIA)	Assessment of local environmental impacts of projects	Impacts on exposed area quantified and evaluated with respect to local risk	Focus on project area, interdependency among projects not considered

Strategic environmental analysis (SEA)	Assessment of environmental impacts of plans/ programmes	Quantification of environmental risk on an aggregate scale; comprehensive report	Not detailed enough to capture local risk factors
Climate impact analysis (CIA)	GHG production of traffic, infrastructure provision and influence on related sectors	Measurement of contribution to climate goals	Project scale too narrow, corridor or network scale more meaningful
Extended analyses	Capture additional effects which are not quantified by partial analysis	For large projects, project packages and network configurations very relevant	No standard existing Limited comparability Further development necessary for practical application
Spatial computed equilibrium modelling (SCGE)	Economic equilibrium approach to measure secondary impacts	Regional economic impacts and social equity included, + feedbacks with the economic system	Small number of economic sectors, highly aggregated IO-tables, difficult integration of techn. change and dynamics, no integration of environment
System Dynamics Modelling (SDM)	Simulation of feedbacks between transport, economics and environment	Integration of all relevant feedbacks Capable of handling high complexity	Partly dependent on "mental creativity" of the analyst Control of large systems difficult
Regional economic impact analysis	Econometric estimation of impacts on regional development	Explicit consideration of regional endowments and development potential	No standard existing Limited comparability

Source: own elaboration

In the following we present examples for

- quantification of transport impacts as a basic input for assessment,
- guides for CBA, MCA, EIA and SEA, developed for the European Commission and UNECE,
- applications to the investment programmes of the TEN-T guidelines 2004 and 2011, and
- extended approaches to quantify secondary impacts and the European added value.

2.2. Forecasting changes of traffic patterns

TEN-T constitutes a continental network of which single projects may extend across several Member States. Thus, differences in the required tools and scope compared with projects of mere national character need to be considered. In several member countries standardised transport models have been developed on the basis of clear methodological specifications in compliance with the national assessment schemes (e.g.: UK, NL, France, Germany) while in other countries consultants apply commercial software packages or their own developments according to the requirements of their clients.

Since the early 1990s the European Commission has commissioned a series of studies and research framework projects in which European network models were developed and applied for assessment of TEN-T networks. During the period of the 14 Essen projects the SCENES model was most relevant for European assessments (ME&P et al. 2002). When it comes to the re-structuring of the TEN-T by defining 30 priority projects in 2004 the assessment was largely based on the NEAC (Chen/Tardieu 2000) and VACLAV models (Schoch 2004). All models used the "four-step approach" of transport modelling (generation, distribution, modal split, assignment) and applied the European nomenclature of spatial modelling (SCENES: NUTS 2; NEAC/VACLAV: NUTS 3).²

However, all of these models remained under the control of their developers making it difficult for third parties to trace and validate their findings. Data and model information was not publically provided - pointing to the lack of a contractual requirement to "deposit" data and model documentation for ex ante / ex post usage. The European Commission decided to contract the development of an IPR free European transport network model, called TRANS-TOOLS. The first version of TRANS-TOOLS was completed in 2006 and was implemented by a modular structure (based on NUTS 3 regional modelling for EU 27+2) making use of experiences gained with previous models like NEAC, VACLAV (Burgess et al. 2006). The second version of TRANS-TOOLS was developed in the TEN-CONNECT project (Petersen et al. 2009). Variants of this version were used both for the assessment of the Transport Policy White Paper (European Commission 2011a) and the TEN-T core and comprehensive networks (European Commission 2011b, Petersen et al. 2011). Remaining problems like calibration of the model, incompatibility between some modules of TRANS-TOOLS version 2 and still existing IPR limitations make it necessary that currently a TRANS-TOOLS version 3 is being developed to overcome these problems and finally provide the European Commission and other users with a well-functioning and open European transport network model, which can provide reliable framework data on the transport impacts of TEN-T investments, to be used as a baseline for more detailed national forecasting approaches.

2.3. Guides for CBA and MCA, EIA and SEA, developed for EC and UNECE

2.3.1. CBA guide for DG Regio

Cost-benefit analysis has a long tradition in transportation planning and has been a requirement in cohesion policy since the year 2000. A first guide has been developed for the European Commission services in the late 1990s to support the differentiation of rates of Community assistance for ERDF, CF and ISPA fund. TRT et al. (European Commission

² An overview on European transport policy analysis models of that period is provided by Eijkelenbergh et al. (2004).

2008) have developed the Guide further into an operational agenda for the project examiners of transport, energy and telecommunication infrastructure projects. The Guide includes the following steps:

- Project identification
- Feasibility and option analysis
- Financial analysis
- Economic analysis
- Risk assessment.

The basic concept of the economic analysis is to set the economic framework right. While most approaches start from the neoclassical methodology of partial measurement of consumer's and producer's surpluses and add up the external (non-market) impacts of a project, this Guide starts from an equilibrium analysis under constraints, i.e. taking into account the various departures of economic reality from the neoclassical world of perfectly functioning markets. This follows the tradition of Little and Mirrlees (1974) and Dasgupta, Marglin and Sen (1972), which consider a situation of the economy with widely distorted markets and prices so that the partial equilibrium approach is a priori not appropriate. They suggest evaluating the impacts of social investments on the base of shadow prices (opportunity costs). Theoretically the shadow prices are a by-product of an optimal planning under various constraints (economic, social, environmental), i.e. if such prices were set in the economy then an optimal position of the economy under constraints would be reached. In reality it is not possible to construct a complete general equilibrium model with all relevant constraints.

Therefore the Guide suggests going through the set of prices for all relevant changes for the supply of tradable goods and checking them for necessary corrections in direction of shadow prices (or opportunity costs, in other terms). The Guide gives general advice for the conversion of market prices to accounting prices for CBA, as for instance for tradeable and non-tradeable goods, for labour force, resource inputs and cross-border trade. Examples and case studies show good and bad practice in this respect.

The Guide also discusses alternative methods such as cost-efficiency analysis, multi-criteria analysis or economic impact analysis (see also Table 4). It concludes that these approaches *"cannot be seen as substitutes for CBA but rather as complements for special reasons, or as a rough approximation when actual CBA is impossible"* (European Commission 2008, p. 66). Therefore these methods should be used with caution in order to avoid inconsistencies across regions and countries.

While the basic CBA approach has the merit to reconcile the theoretical conflict between the partial project approach and the general equilibrium approach under constraints it is very hard to implement, in particular in accession countries. The determination of the right conversion factors requires great economic expertise and can hardly be performed on an administrative level. Therefore in practice simpler partial methods are applied and in accession countries they are amalgamated to very rough and simplified analyses of changes of generalised costs, possibly enriched by accident and environmental cost changes.

2.3.2. MCA proposal of UNECE

Against the background of the great professional expertise necessary for a qualified CBA and its extensive data requirements, the UNECE is suggesting a multi-criteria analysis. UNECE (2003) has elaborated TEM (Transeuropean Motorways) and TER (Transeuropean Railways) masterplans whose goal was to present a consistent and realistic short, medium and long-term investment strategy for road and rail (former TINA-) backbone networks. The criteria were clustered into:

Cluster A: Horizontal Dimension: Functionality/Coherence Criteria:

- International connectivity
- Particular transit transport needs
- Connection of low income countries to major EU and Asian markets
- Crossing natural barriers, remove bottlenecks, fill missing links

Cluster B: Vertical Dimension: Socio-economic Efficiency and Sustainability Criteria:

- High degree of urgency
- Pass economic viability test
- High degree of maturity
- Financing feasibility
- Environmental and social impacts.

Several methods have been investigated to implement the critical steps of MCA as are the normalisation and the utility aggregation procedures, e.g. pair-wise comparisons (see Roy, 1968 or Saaty, 1980), Delphi method or Multi Attribute Utility Theory. Application was planned for 21 countries while 14 countries submitted data on projects under evaluation.³ This method has been suggested by the Slovak central research institute on transportation (VUD) to assess the transport investment projects for the next Slovak operational transport programme 2014–20. JASPERS and their experts found that the method includes double counting of benefits and risks of inconsistency. In particular it mixes up instruments (like bottleneck removal) and objectives (like reduction of generalised costs) and should therefore be treated with care. Furthermore, the method has been developed separately for road and rail which implies that an intermodal comparison and ranking of projects is not possible.

2.3.3. EIA, SEA and CIA

EIA (Environmental Impact Analysis) is mandatory for all projects which have significant impacts on the environment. The legal base has been set with Directive 895/337/EEC), revised by Directive 2011/92/EU and currently considered for further revision according to proposal COM(2012)628 final. According to article 3 the direct and indirect effects of a project on the following factors (abbreviated here) have to be considered:

³ Bosnia-Herzegovia, Bulgaria, Czech Republic, Greece, FYROM, Hungary, Lithuania, Poland, Serbia, Slovakia, Slovenia, Turkey, Ukraine.

- population, human health, biodiversity;
- land, soil, water, air and climate change;
- material assets , cultural heritage and the landscape;
- exposure, vulnerability and resilience with respect to all factors mentioned above, including natural and man-made disaster risks.

EIA can be partly integrated in CBA, which is in general restricted to the monetary impacts of traffic (parts of effects of noise, air pollution, GHG emissions). MCA can integrate the full set of EIA criteria.

SEA (Strategic Environmental Analysis) according to Directive 2001/42/EG is mandatory for plans and programmes for transport, if they have significant environmental effects, in particular if they need assessment under the Habitats Directive 92/43/EEC. Annex II of Directive 2001/42/EG sets out the criteria which require an SEA, the characteristics of effects and of the area likely to be affected. The German Ministry of Transport plans to integrate SEA into the socio-economic assessment method for transport infrastructure investments. Criteria which can be monetised are allocated to the CBA while non-monetised criteria are allocated to MCA evaluation (see Bosch and Partner, 2010).

CIA (Climate Impact Analysis) is an issue which has become even more relevant through the European Commission's White Paper on Transport Policy (2011a) which sets clear targets for CO₂ reduction in the transport sector (minus 60% until 2050 compared with 1990). While the CO₂ impacts of traffic are often included in CBA for transport projects, the impacts of infrastructure provision and on related sectors or upstream/downstream effects are not considered.

2.4. Applications to the investment programmes of the TEN-T guidelines 2004 and 2011

2.4.1. Impact assessment for TEN-T priority projects of 2004

The transport forecasting and impact assessment for the TEN-T 2004 was done by the TEN-STAC consortium (NEA et al. 2004). Three scenarios have been developed for the forecasting year 2020: Trend, European and European+. All include the basic infrastructure measures (completion of projects started) as well as the baseline socio-economic trends. The three scenarios differ with respect to accompanying liberalisation and harmonisation policies and the volume of infrastructure measures (European+ scenario includes all TEN-T measures suggested by the van Miert group, HLG 2003). Upon request of the European Commission these scenarios have been evaluated using a "partial CBA" approach. This includes the components:

- CO₂ emissions
- Emissions of NO_x and particulates
- (Potential) travel/carriage time savings
- Cost estimates for infrastructure measures.

All components are quantified in monetary terms while for the environmental impacts the Infrac/IWW study on external costs of transport (2000) was taken as a basis. Time savings have been computed using the transport model, which allowed for modelling congestion

costs and evaluating in monetary terms by using the values of time published in the UNITE study (2002) for the European Commission.

Several additional impacts have been quantified, such as regional accessibility and centrality indicators or the transport volumes on major corridors or the share of international transport on major corridors, which could have been used as inputs for estimating the European added value. These outcomes are only reported but not considered in the partial CBA.

As a result the European and European+ scenarios come out with significantly greater benefits compared with the trend scenario. But relating the estimated yearly monetary benefits to the annuity of investment cost lead to a benefit/cost ratio of about 1 (European scenario slightly lower; European+ scenario slightly higher). The authors identify the reason for the low figures with the partial approach, neglecting a number of impacts which would increase the magnitude of benefits.

2.4.2. Impact assessment of core network configurations 2011

TML et al. (2010) have developed a methodology for the European Commission to support the decisions to be made for constructing the TEN-T core network. This method starts with the choice of nodes and links connecting these nodes and their composition to form corridors and finally the core network. The methodology builds on the ESPON classification of European Metropolitan European Growth Areas (MEGA). Using the hierarchy of MEGAs and the accessibility between MEGAs, the links between the selected nodes have been constructed to form a TEN-T core network and a comprehensive network. This methodology has been further improved and used to derive the new proposal for the TEN-T guidelines in 2011 (European Commission 2011e).

The European Commission has established an Impact Assessment Steering Group (IASG, Dec. 2010-April 2011) which developed a proposal for impacts assessment, published by the Working Paper SEC (2011)1212 final of October 2011. This proposal follows the idea of evaluating network configurations instead of single projects (see section 2.5) and develops an evaluation scheme which is intended to overcome the weakness of a partial CBA approach. The scheme starts from general goals as they are stated in the White Paper of 2011. These objectives are translated into more detailed objectives and criteria which allow for a quantitative measurement.

Five options for the planning of transport infrastructure are defined and crossed with 5 options for implementation. At the end three scenarios were examined:

- Business as usual
- CORE (dual layer concept with core and comprehensive network)
- COMP. (dense TEN-T with reinforced coordination).

The detailed definition of the scenarios and their translation into the context of transport and impact modelling can be found in the TENconnect II study for the European Commission. TENconnect II uses the TRANS-TOOLS model which generates the transport figures and some impacts figures which are directly related to transport volumes, such as generalised costs, accidents or exhaust emissions (Petersen et al. 2011).

The impact analysis of these policy options includes economic, environmental and social criteria. On the economic side also indirect effects are considered besides the mandatory CBA impacts (generalised costs, accident costs). The social side includes employment, public health, safety, accessibility and territorial cohesion. Environmental indicators are climate change, air pollution, noise, land use and biodiversity (Natura 2000). Also energy use is quantified.

To summarise all measured impacts a cost-benefit comparison is exhibited for the extended criteria, including indirect economic impacts. The European added value is derived from a scoring scheme for the effectiveness of options on the European scale. This means that the approach can be classified as a system's approach to determine an optimal network configuration using MCA and CBA.

While the general approach meets the basic requirements for constructing an evaluation scheme for network configurations or policy options, the numerical results are still suffering from several weaknesses. The TENconnect II results which have been used in the assessment part stem from the TRANS-TOOLS model, which is still not mature and does not generate reliable outcomes. Looking into the details, one can find many implausible magnitudes of reactions, such that according to the opinion of EC officers the data can be used as first indications but not as final inputs for evaluation. Other parts of the evaluation exercise had to be based on external studies, as for instance in the case of indirect effects on the economy. It is doubtful whether the external studies which have been used for deriving global figures of macro-economic impacts can be applied to the TEN-T assessment without any adjustment (see for instance the estimation of employment effects).

The conclusion is that a first important step has been taken towards an integrated assessment of network configurations or transport policy options, but the instruments are not yet fully developed to fill the data boxes needed with reliable results.

2.5. Extended approaches to quantify secondary impacts and the European added value

2.5.1. Spatial general equilibrium models and system dynamics models

The European Commission has launched supplementary studies in the 5th Framework Research Programme, as in particular the studies IASON (*Integrated Appraisal of Spatial Economic and Network Effects of Transport Investments and Policies*, 2004) and TIPMAC (*Transport Infrastructure and Policy: A Macroeconomic Analysis for the EU*; 2004). These studies were intended to overcome the limitations of a partial CBA analysis and quantify the overall impacts of the TEN-T investment programme on the economy as well as on the social and environmental objectives. Secondary or indirect impacts, which might dominate the direct impacts for major projects in the long run, are the central issue, IASON focusing on the spatial economic feedbacks while TIPMAC includes sectoral economic impacts, social and environmental impacts.

The evaluation methods applied in the IASON study are the CGEurope model (see section 2.1) and the dynamic simulation tool SASI. SASI runs independently and generates sequentially dynamic adjustment paths for the transport and economic indicators. CGEurope uses the forecasted data for the future development of socio-economic indicators and the associated costs of transport for the year 2020 and models the regional impacts and the welfare including its spatial distribution. A main outcome of CGEurope is the estimation of indirect effects of TEN-T investment which are in an order of magnitude

between 15 and 21% for the different model runs, and 17% on average (to be added to the direct effects of general cost savings). With respect to the spatial impacts the outcomes are positive for the majority of regions but can be negative for regions which do not enjoy significant reductions of transport costs through the investment programme.

The TIPMAC project includes two alternative approaches: a macro-econometric model together with a transport model (E3ME, Cambridge Econometrics and SCENES, ME&P) and the system's dynamics model ASTRA (University of Karlsruhe; see Schade, 2005). ASTRA includes all EU countries plus Norway and Switzerland, uses input-output tables for 25 economic sectors and models the feedbacks between transport, the macro-economy, the regional economies, the foreign trade, the population development (structured by age classes), the technological development and the environment. It allows for generating welfare indicators as well as indicators of national accounts such as GDP, employment or consumption. Combined indicators like tonnes of CO₂ per unit of GDP can be generated. Comparable to SASI, the ASTRA model allows for a dynamic introduction of policy actions over time (infrastructure, regulation, pricing) and the consideration of financing measures for infrastructure investment.

The general finding through ASTRA and E3ME application is that the 2004 TEN-T investment programme will lead to an increase of GDP by 2020 if the financing aspects are not considered on a region-specific level. But as soon as the financial issues are included in the model and it is assumed that the financial budget needed is financed by regional users (e.g.: through marginal cost pricing on the infrastructure) a significant positive impact on GDP of each Member State can no longer be identified. This is interpreted in TIPMAC in such a way that the TEN-T investment programme included infrastructure projects, which are costly for specific regions as they will not completely be needed until the year 2020, possibly they might be viable in the period after 2020. Therefore the lesson from the ASTRA model is to think more carefully about the regional priorities of investment and about avoiding overdesign of projects, in particular if the budgets are becoming more scarce, and consider that additional investment has to be financed by user charges.

2.5.2. Regional economic impact studies

Regional economic impact studies have been elaborated for some large projects, as for instance the Oeresund Bridge or Stuttgart 21, and have recently also been applied to the TEN-T Baltic Adriatic corridor. The common features of such approaches are:

- Definition of economic impacts in terms of national accounts (e.g.: GDP, GVA, employment);
- Construction of regional production functions with transport infrastructure or accessibility as one of the production factors;
- Econometric estimation of parameters of the production factors by cross section analysis (for NUTS 2 or NUTS 3 regions);
- Estimation of induced additional GDP in the impacted regions.

IHS (2012) applies a direct estimation approach, i.e. defining "accessibility" as a production factor and measuring its influence on production. IHS measures the economic impacts in the construction phase (multiplier analysis) and the operation phase (improved accessibility in a regional production function). For the Baltic – Adriatic corridor they come to a positive result in the sense that the additional (discounted) GDP measured is higher than the investment expenditures.

The approach of IWW et al. (2009) defines “accessibility” as a potential factor in a “quasi-production-function”. Statistical estimation of regional quasi-production functions is according to the IHS concept. If accessibility is identified as a serious bottleneck, then the full estimated growth potential is assigned to the benefits. If no bottleneck situation is identified, then the potential growth contribution is not considered. Regional impacts can be identified also outside the region and the country analysed. This gives the opportunity to quantify a European added value. The method has been applied to the Baden-Württemberg 21 project (new underground station Stuttgart with regional PT connections, plus high-speed link Stuttgart-Ulm, as a component of TEN-T corridor PP17).

2.5.3. European added value and leverage effects

The European added value in general characterises the synergy effects which arise beyond regional or national benefits of a project. Following Sim Kallas, the Vice-president of the European Commission, the CEF (Connecting Europe Facility) is the “*best example of European added value*’ that the EU budget can and must deliver. It puts EU resources into projects that are important for the whole of Europe” (Kallas Speech 12/53 at EESC Conference, Dec. 12, 2012, Brussels). Beyond this general statement there should be a more precise definition of the European added value which gives an opportunity for quantitative measurement.

In the context of CBA the European added value can be defined as the net benefits which occur in other countries than the country of investment. This can be measured by counting up all savings of generalised and external costs alongside the respective corridor and subtracting the cost savings within the country of investment. European added value in this sense can be expected for:

- Border-crossing sections of corridors;
- Points of modal interchange and network connections (TEN-T/regional networks);
- Removal of bottlenecks and closing missing links in the environment of borders.

In an extended context the secondary effects on the economies stemming from feedback loops between transport and the economy outside the country of investment can be added. Examples are the approaches of IHS (2012), IWW et al. (2005 and 2009), Schade (2006) or Proost et al. (2010). The secondary effects include the repercussions which follow the initial direct effects and can be measured by welfare indicators or indicators of national accounting (GDP, GVA).

The documents of the Commission mention at various places the expected leverage effects of EU funding, for instance in the CEF document (European Commission, 2011d) or in the Kallas speech 12/53. These figures (e.g.: multipliers between 5-20) give an indication for the expected secondary effects but cannot serve as a concrete instrument for measuring these effects. Therefore the setting of a standard for defining and measuring the secondary benefits seems to be necessary.

2.6. Impacts of the economic crisis

The impacts of the economic turmoil in the years 2008-09 are illustrated by several indicators (EU 27, see EU Transport in Figures, 2012):

- Reduction of GDP 2009/08: 4.3 %.
- Increase of unemployment rate 2010/08: 2.6 %.
- External trade was hit dramatically, in particular in the export-oriented countries.
- Passenger transport (pkm) went down by about 2% while freight transport (tkm) dropped by about 14% 2009/07 and recovered in 2010 by 5.3%. In export oriented countries the temporary decrease of freight transport was more than 20%. All transport modes were hit, in particular road, maritime and air transport.

The first years after the crisis have shown that there is no smooth bounce back movement of the economy to the previous growth path. Most states have invested economic stimulus packages to create more demand in the critical phase to avoid a breakdown of the economies comparable to the 1929 crisis. While this was successful, a number of serious follow-up problems emerged which are still unsolved:

- Financial crisis of Member States stemming from unbalanced foreign trade and the needs of saving and re-organising relevant bank organisations;
- Needs for budget consolidation in a phase of stagnating economies;
- Need for stabilising the banking sector and reducing risky financial operations (regulation/taxation on financial transactions; Basel III);
- Need for restructuring and financially supporting vulnerable economies with unbalanced sector structures to restore or create their basis for competitiveness.

The International Transport Forum (ITF, 2009) has developed three scenarios: "Bounce back" (return to previous growth rates within 5 years), "regional communities" (to depict a slowdown of globalisation) and "retrenchment" (to describe a longer adjustment process with low growth of the economy). The European Commission (DG ECFIN, see Hobza and Mourre, 2010) has worked out a similar view of the development of economy and transport, entitled "rebound", "permanent shock" and "lost decade".

Further reform scenarios have been developed for the European Commission⁴ or for Member States Ministries⁵. They start with the hypothesis that a crisis can be used as a chance for structural change, which leads back to the fundamental theory of economic dynamics by J.A. Schumpeter (1952) and his paradigm of "creative disruptions". It was concluded by all scenario authors that the most optimistic and pessimistic scenarios do not appear highly probable. Therefore the scenario "lost decade" appeared to be the most realistic, which means that the EU economies move to the growth rates forecasted before the crisis after 10 years, but at a significantly lower level and including structural change after a phase of "creative disruptions".

⁴ Hobza, A. and G. Mourre, 2010: Quantifying the potential macroeconomic effects of the Europe 2020 strategy: stylised scenarios. Economic Papers 424.

⁵ E.g.: Rothengatter, W. Krail, M. and G. Liedtke: Simulation von Strukturveränderungsszenarien. Simulation of scenarios for structural change. Report to the German Ministry of Transport. 2011.

If this is taken as a point of departure then four aspects are relevant:

1. The economic growth path and the related trajectories of transport development will be significantly lower than forecasted before the crisis. This implies that the forecasts made for projects on the base of old growth figures will have to be revised, taking into account possible structural change.
2. The expected volume of the financial budget for the EU will probably not be achieved. The difficult budget negotiations for 2013 and the compromise found in December 2012 indicate the growing budget problems. The 2013 proposal of the European Commission (EUR 138 billion) has been cut to EUR 132.8 billion. The planned supplementary budget has been reduced from EUR 9 to 6 billion, so that the overall gap between budget plans and negotiation result is more than EUR 8 billion.
3. A first consequence is that the forecasts underlying the assessment approaches to TEN-T projects will have to be revised if they have been based on economic perspectives set up before the crisis. This may imply a reduction of expected benefits of projects.
4. A second consequence is that a revision of EU funding plans for the next multi-annual programme may be expected. If a reduction of the funding of agriculture and forestry is not feasible because of the strong resistance of some Member States, then one has to expect a substantial reduction of the projected TEN-T and ERDF/CF co-funding.

This implies that the projects foreseen for the multi-annual programme 2014-2020 may have to undergo a more serious check for funding eligibility than expected. This means that an eventually more modest project design and an increased use of user finance may be considered to realise the desired volume of projects.

3. PROBLEMS WITH TEN-T IMPLEMENTATION

KEY FINDINGS

- Problems of TEN-T implementation can be broadly classified into two categories: **problems of strategic planning** and **problems of the underpinning studies**.
- The **European Court of Auditors (ECA)** carried out a number of important audits on the TEN-T funding policy and more broadly on the co-funding of transport projects by the EU. Most relevant were the **audits published in 1993, 2006 and 2010**.
- The ECA noted that in early phases of developing the TEN-T network a lack of selecting projects based on proper evaluations could be observed. Conditions for selection of projects remained unclear or were not enforced. **Selection of projects often followed political decisions** rather than sound assessment calculus.
- At least **since 1996 the conditionality existed that only projects which are potentially economically viable should be taken into account for TEN-T co-funding** by the EU.
- Implementation of TEN-T is delayed as **monitoring of progress was hampered due to the lack of guidelines** for reporting progress and for monitoring.
- A clear definition of **ex-ante conditionalities will strongly support steering the development of the TEN-T networks** in the direction of objectives defined by the European transport policy and to speeding up the implementation of the TEN-T by prioritising these network elements.

Implementing a strategic European-wide transport network in a situation in which Member States individually keep the responsibility for developing their national transport networks is the key challenge of the TEN-T implementation. Regulation and setting incentives were both applied to structure this implementation process. Regulation was successful for considering environmental impacts in the planning process. DG MOVE and DG REGIO, the two co-funding entities of the European Commission, both report in personal communication that they always verify that the environmental regulation of EIA and SEA is respected by transport projects proposed for co-funding. However, the process and criteria of assessment and selection of projects differs between the two DGs, which is rather a disincentive.

Obviously one incentive is the co-funding itself. Other incentives such as the requirement for proposing economically viable projects were less appreciated, though they should be in the interest of both the EU and the Member States. Until 2006 socio-economic assessments were often carried out in a non-structured way, or were even missing completely.

3.1. Findings of the European Court of Auditors (ECA)

The European Court of Auditors (ECA) has since 1987 occasionally discussed the subject of transport infrastructure funding by the European Community. The first special report of the ECA dedicated to the analysis of all sources of European funding for transport infrastructure in the EU was published in 1993 (ECA 1993). The ECA observed that between 1982 and

1991 ECU 24.5 billion were spent by Community funding. 75% of projects to be completed by the end of 1991 were delayed (p.7). In many cases European funding was only used to refund national expenditure already settled, instead of generating additional investment and infrastructure (p.9). Existing impact studies at Member States level were not systematically used for taking decisions about Community funding and the consultation between the different funding DGs (in particular the DGs for transport and for ERDF) was weak (p.11). The ECA concludes that these weaknesses were due to the *"lack of any formal structure for monitoring, controlling and, above all, coordinating infrastructure investment"* (p.9).

After addressing transport briefly in subsequent annual reports, the ECA delivered its next special report dedicated to the TEN-T network in 2005, which was then published together with the European Commission's response in 2006 (ECA 2006). Though improvements have been made, a number of the earlier identified weaknesses remained. However, the response of DG TREN indicates that while the ECA was working on its report, in the years 2005-2006 substantial progress was made, e.g. by laying the foundations to establish the TEN-T Executive Agency (TEN-T EA). One of the ECA's procedural concerns was that full project information was not available at the preliminary evaluation and selection stages (p.11). Due to this lack of information required for taking decisions on project funding, together with the lack of justifications by evaluators, it remained unclear how the European Commission staff concluded whether conditions or formal requirements are fulfilled to select a project proposal (p.12). This led the ECA to assume that the multi-annual indicative programme (MIP) has been allocated without a proper assessment of the legally required criteria (p.12). The ECA then suggested that Member States should prioritise their project proposals on the basis of clear eligibility, selection and award criteria that should be established by the European Commission (p.18), which would then deviate from the procedure that Member States assess and select projects on the base of their country-specific assessment approach. The ECA then proposed a two-step evaluation approach, with a first step assessing essential criteria such as the basic conditions for financial aid, economic viability, maturity and the compatibility of a project with environmental legislation (p.19). In their response European Commission DG TREN confirmed that it is already or will be developing such appraisal guidelines, tools and methodologies for TEN-T project evaluation (p.35).

In 2010 the ECA published its next important report related to the rail infrastructure investment on the Trans-European rail axes (ECA 2010). The ECA acknowledged that progress has been made concerning many of its previous recommendations related to TEN-T project funding (e.g. delegation of tasks to the TEN-T EA, involvement of external experts and establishment of co-ordinators for priority projects). However, insufficient technical review of proposals was identified for projects decided and co-funded by the Cohesion Fund, though after 2007 the procedures for project approval have been adapted. Further and even more important was the observation of the Court that only summary information on cost-benefit analyses (CBA) of proposed projects has been submitted, which made it difficult to compare different project proposals (p. 29). Regarding the improvement of CBA DG, TREN replied that the largest share of funding lies with the Member States so that the onus for a proper CBA should fall on the Member States. Obviously this would not hold for all projects funded by DG REGIO, which partly receive by far more than 50% funding from the European Union.

The operative provision that economic viability of a project that could be proven by a CBA should be demonstrated by proposed projects for Community funding and should be considered as selection criteria has been repeatedly formulated by the Court since 1993. As this still seems not to be fully implemented the European Parliament is requesting

amendments to the TEN-T guidelines of 2011 concerning the requirement of carrying out a socio-economic CBA and obtaining a positive net-present value (NPV) for projects to be selected for Community funding. Further, the EP requests an amendment that by January 31st 2014 the European Commission will have to develop a detailed methodology for such a socio-economic CBA (Koumoutsakos/Ertug 2012).

3.2. Conditionality and lack of enforcing conditionality

Conditionality means that certain conditions need to be fulfilled so that a proposed project can be considered for Community funding. In the debate of new TEN-T guidelines and a revised Community structural funding policy of 2011-2012 the term ex-ante conditionality gained massively in importance. However, already in the past eligibility criteria constituted conditions that need to be fulfilled ex-ante. As the ECA observed (see section 3.1) these conditionalities were often not respected and lacked enforcement. This section briefly describes the most relevant past ex-ante conditionalities and then explains important modifications discussed in the on-going debate.

3.2.1. Ex-ante conditionality in early TEN-T network development

The first guidelines for the development of the TEN-T required that "*only projects which are potentially economically viable should be taken into account*" (European Union 1996). Thus the request to generate a positive economic impact by a co-funded project existed since the first guidelines, though no obligation was established to prove the viability e.g. by a cost-benefit ratio larger than 1 or a positive NPV.

Environmental impact assessment (EIA) in compliance with Directive 85/337/EEC and 2011/92/EU is another condition for Community funding of projects. Community funds cannot be used to finance projects unless the relevant impact assessment has been completed. This holds for transport projects since the Directive is in force.

TEN-T funding is also made subject to the fact that a proposed project was part of the TEN-T network specified at a certain point of time, i.e. with the set-up of the first guidelines it should be part of the 14 Essen projects. As of 2004 the projects should be part of the 30 priority projects (PPs).

The structural fund managed by DG Regio reveals an additional conditionality: a proposed TEN-T project must fit into the objectives defined by the Operational Programme (OP) under which a project has been proposed for funding.

3.2.2. Ex-ante conditionality – example of cohesion funding

Against the background that the major part of EU funding for transport investments stems from ERDF and CF, it is necessary to look closer into the funding principles and their enforcement in the past and the future.

In the conclusions of the Fifth Report on Cohesion of the European Commission (European Commission 2010a) it is found that the cohesion policy should have a greater focus on *results* and the reforms needed for their achievement. Concrete proposals are made to increase efficiency of public spending. First of all, the automatic de-commitment (N+2) rule was reinforced to avoid too large a time gap between fund allocation and spending or the stricter ear-marking rules for certain categories of expenditure, in particular for convergence regions, helped to concentrate regional funding.

For the period after 2013 the European Commission proposes a more closely supervised cohesion policy. The principle of subsidiarity which had governed cohesion policy in the past is complemented now by the principle of ex-ante conditionality. The use of funds is conditioned and restricted to defined priority criteria.

Four types of conditionality have been defined:

- Macro-economic conditionality
- Ex-ante conditionality
- Conditionality linked to structural reforms
- Performance conditionality.

For funding transportation projects the ex-ante conditionality is most relevant. It includes three prerequisites:

- Transposition of EU legislation into national law linked to regional policy;
- Existence of national or regional strategic frameworks for each type of investment (as e.g. infrastructure);
- Efficiency of institutional or administrative structures in place, so as to guarantee sound management of the funds (administrative capacity).

As long as the three prerequisites are not fulfilled the European Commission can suspend any corresponding payments.

3.2.3. Comprehensive strategic transport planning

The second prerequisite of the above list is interpreted by DG Regio and JASPERS in the way that Member States applying for co-funding from ERDF and CF for the multi-annual programme 2014-2020 have to prepare a strategic transport plan. Such a plan should include⁶:

- A medium-term and long-term multi-modal forecasting
- A sound assessment of multi-modal network configurations
- An integration of SEA and CIA for the assessment of the investment programme
- A sound assessment of projects including EIA and of their integration into the strategic plan
- A clear priority setting for the medium term (phase 1) and a development plan for the long-term (phase 2)
- A financial plan which integrates all financial sources, including budget allocations from the member state, private co-funding (e.g.: PPP) and EU co-funding for the medium-term with an outlook to the long-term future.

It is expected that the national transport plans follow the strategic goals defined in the White Paper 2011 on common transport policy (European Commission 2011a). The present situation is that not all 2004/2007 accession countries are able to prepare such kinds of comprehensive strategic transport plans on time. Therefore intermediate solutions are

⁶ see the Czech tender for preparing the strategic transport plan, 2011, which was supported by JASPERS

necessary for phase 1 to leave these countries the option to apply a co-funding of projects for the next Operational Programme on Transport (OPT).

3.3. TEN-T planning: in the past a political process

The TEN-Invest project (2003) collected data on TEN-T investments since the publication of the guidelines in 1996 and on the plans for TEN-T investments until 2010, including the TINA networks to be developed for the 2004/2007 accession countries. TEN-Invest also reviewed the project evaluation and selection schemes applied by the Member States. The project concluded that *"it must be stated that in all countries, appraisal is used for prioritising projects, making recommendations and for evaluating alternative options but not for making a final decision, which is always political"* (Planco et al. 2003, p. 54). This finding could also be observed for the TINA assessment in which the network model-based quantitative results (TINA/European Commission 1999) were questioned by the policy-makers with regard to fostering decisions on political grounds (Peters 2003).

In 2009, the European Parliament in its response to the Green Paper on the TEN-T policy review (European Commission 2009a) still pointed out that the priority projects forming the TEN-T network constitute a "wish list" inspired by national interests (European Parliament 2009a). Thus until then it must be assumed that project selection of TEN-T projects and funding was rather a political process than one based on analytic results of benefits and costs of the various potential projects.

Nevertheless the TEN-T guidelines of the past have contributed to coordinating national with European network development goals. Using the principle of "additionality" the European Commission could supplement the financial resources of the Member Countries and make an earlier implementation of projects possible. In the recent proposal of the TEN-T guidelines of 2011 the weight of European versus national goals has been increased. When it comes to stricter eligibility rules for funding and enforced control/monitoring by the European Commission, one has to consider that a 10% co-funding does not imply the same level of governance as a 85% funding through ERDF/CF. While in the first case the EU co-funding adds to a major national funding and implies that the national rules of decision-making may dominate, this does not hold for the second case. This means that the level of EU control and monitoring should be "proportional" to the level of co-funding.

3.4. Summary of problems of TEN-T implementation

For the purpose of this summary we have drawn up a process scheme describing a well-developed process of TEN-T project assessment, selection and funding (see Figure 2). The problems that we identified in the previous sections concerning the selection and funding of the TEN-T can be identified in the scheme as well.

Problems in the decision process on TEN-T funding can be divided into problems of the strategic planning and of setting-up and undertaking the ex-ante and ex-post studies. Potential failures of strategic planning may occur in the boxes indicated by light blue in Figure 2, in particular they may include:

- Lack of or flawed definition of strategic goals.
- Lack of or flawed national strategic transport plan or European strategic plan.
- Lack of or flawed public participation.

Potential failures on the undertaking of studies can be identified by orange boxes in Figure 2. They could include:

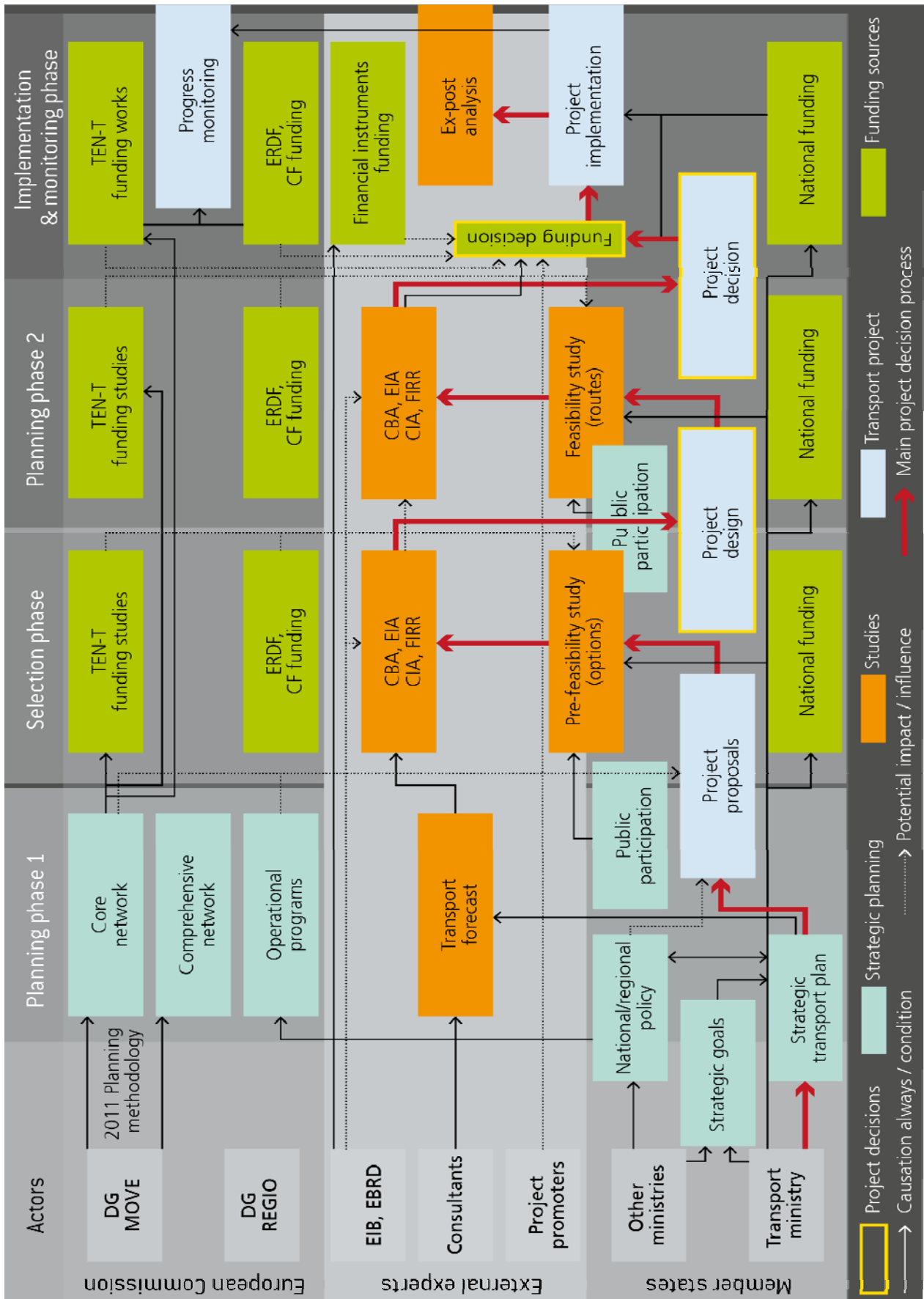
- Lack of or inappropriate transport demand forecast (e.g. problem of optimism bias).
- Insufficient scoping and definition of alternative options in the pre-feasibility study.
- Lack of or flawed CBA or EIA in the pre-feasibility study.
- Insufficient screening and definition of alternative routes and engineering options in the feasibility study.
- Lack of or flawed CBA or EIA in the feasibility study.
- Insufficient consideration of CBA or EIA results when deciding about project design or about the final project.
- Insufficient risk management when taking the funding decisions.
- Lack of or flawed ex-post analysis.

The lack of SEA or CIA would be a combined failure of strategic planning as they form rather part of the strategic plans and not of a project, and of flawed studies as they also constitute (part of) a study.

Figure 2 presents a well-developed decision-making process on TEN-T projects with the intention of showing the complex interactions between the three main actors Member State(s), European Commission and External Experts (horizontal levels), the latter comprising in particular the project promoters and the funding agencies. A proper completion of the strategic planning as part of the initial planning phase 1 is a prerequisite to enter in the steps of the decision-making process that deals with single projects. At the end of each of the four phases a transport project has reached the next level of maturity starting with proposed projects, designed projects, decided projects and projects in implementation. We have indicated the main decision process on a project (red arrows in Figure 2). To become implemented a project must be part of the national strategic transport plan, then be subject to a pre-feasibility study with CBA, EIA and financial analysis leading to a preferred project design, which in turn is made subject of a detailed feasibility study preparing the CBA, EIA and financial analysis required to take the implementation decision and the funding decision. Public participation in the (pre-) feasibility studies is a strategic element for improving the decision base and decision-making as well as for increasing acceptance of a project.

Other influences are affecting this process (bold black arrows) or may affect this process (dashed black arrows). An example of the former is the transport forecast that will always be required for the ex-ante economic, environmental and financial studies. An example of the latter would be the influence of project promoters or the European Commission interested in the implementation of specific projects (e.g. cross-border projects or potentially tolled projects). Further potential influences concern the co-funding of studies by the European Commission e.g. TEN-T funds, ERDF funds and/or CF funds.

Figure 2: Decision-making process on TEN-T funding and problem issues



Source: Fraunhofer-ISI

4. CASE STUDIES OF LARGE TEN-T PROJECTS

KEY FINDINGS

- **Cost increases during the course of the project were identified for several projects.** However, **reasons differ** and include extensions required to mitigate environmental impacts, consideration of inflation, adding further sections to the project or altering the specifications and objectives of the project mainly in the planning phase.
- **Methodologies of Cost-Benefit Analysis (CBA) vary widely** and so do the input parameters. **A standardised methodology or at least standardised parameters would be desirable** for projects submitted for TEN-T co-financing. Then minimum viability criteria could be introduced for selecting projects for co-funding depending on the mode and on the country's economic level.
- **Environmental Impact Assessment (EIA) is required and carried out for all projects.** However, depending on the country and on the point of time the formal EIA requirements differ and have evolved over time, as do the EIAs. Early EIAs of the 1990s would often not comply with today's EIA requirements (the EU EIA Directive was revised several times).
- **Strategic Environmental Assessment (SEA)** for plans and programmes is obligatory but not always applied for large projects. In some cases it is announced for a later planning phase.
- **Today Climate Impact Assessment (CIA) is not legally required** (the European Commission has recently proposed including CIA in the EIA Directive). GHG or CO₂ emissions from transport activities are usually part of environmental assessment of large projects. Further climate impacts stemming from the provision of infrastructure, vehicles or energy generation are not considered.
- **Transparency has improved over the past two decades.** For large-scale projects developed more recently detailed studies are often, albeit not in all cases, made available publicly, whereas past projects often classified them as confidential. **Public availability of underpinning studies could still be improved.**
- Large cost overruns or increase of estimated investment costs occurred in selected cases. **Parliamentary debate then helped to shed light on the causes of the cost overruns** and the flawed process of project development. Cost overruns would result from flawed planning, but only show up in the construction phase. Adverse impacts of cost overruns could be mitigated by risk management. **Differentiation of cost increases during planning and during construction is helpful for analysis of causes for cost overruns.**
- **Information about TEN-T projects is fragmented** at different DGs of the European Commission, national ministries, project promoters, consultants, etc. This leads to unnecessary intransparency jeopardising the public acceptance of projects.

This section first explains how the data on the case studies was collected and, second, presents a summary of each case study, while the detailed results are reported in the annexes. This summary section is followed by five sections explaining specific findings regarding ex-ante and ex-post studies on economic and environmental aspects as well as processes of TEN-T assessment and reporting.

4.1. Methodology to obtain official documents for case studies

The case studies were built on available documentation of the selected transport projects. As transparency about TEN-T co-funded projects was an issue, the primary source should have been publicly accessible documents about TEN-T projects, i.e. documents that could be obtained via desk research on the internet or via libraries (citizens' perspective). Unlike the EVA-TREN (2008) project, on-site visits of archives were not possible due to the short project duration.

It was expected that documentation in the public domain, at least for a number of projects would be limited. Therefore also desk research on documents with restricted access for the public was planned as well, e.g. in databases maintained by the TEN-T EA (e.g. TENtec Information System, EIB analyses, other funding agents analyses). Further, interviews/contacts with experts at the European Commission, European project coordinators, project financiers and project promoters were foreseen. This was largely performed via telephone and/or email, but some face-to-face interviews were conducted during the TEN-T days 2012 in Brussels. Further, the expertise from previous participation of the contractors in the assessment and selection process of TEN-T projects was an important source as well as the contact with the European Parliament.

Pure desk research as well as the access that was provided by TEN-T EA to the TENtec Information System generated only a limited number of hits, in particular concerning the more detailed ex-ante cost-benefit / economic studies, transport impact studies, financial studies, environmental studies as well as detailed ex-post studies. Therefore a much larger number of persons were contacted than originally planned and expected. This involved persons at DG MOVE (>10), DG REGIO (>5), TEN-T EA (>5), European project coordinators (4), National Ministries (>10), financial institutions (EIB, KfW, JASPERS, >5), project promoters and project operators (>15).

Some generic observations apply. More recent projects, in particular when still in the planning phase, seem to adapt already to requirements to become more transparent and provide more detailed studies online (e.g. Rail Baltica) or on request (e.g. Fehmarn Belt Fixed Link). For projects dating back longer either scientific literature describes their development and planning or public debate in media and parliament provides secondary sources of data (e.g. Betuwe Line, WCML), though the original documentation was only in printed format and could not always be obtained. In some cases, studies could only be provided in the national language, which requires additional efforts to undertake analyses. According to some experts this is increasingly the case, complicating assessments at European level and with a wider involvement of the European public. In several cases we are aware that documentation should exist, but it remained confidential and thus could not be used for this study (see also section 4.5).

4.2. Summary of the individual case studies

Table 5 provides an overview of the ten case studies. Four case studies are in the planning phase, four allow for an ex-post analysis and two are still under construction. The costs of the projects range from about EUR 130 million to EUR 12.4 billion. Available benefit-cost ratios are in a range between 0.5 (actually a dis-benefit) and 6.4, while economic internal rates of return are in the range between 5.3% and 9.4%. It should be pointed out that the figures have not been derived by harmonised approaches, so that comparisons need to be interpreted with care.

Table 5: Overview of the costs and assessment results of the case studies

No	Selected TEN-T projects	Status	Cost EUR million	BCR / NPV / EIRR	EIA	CIA
1	Brenner Base Tunnel (AT/IT)	planning	8 585 including risks	1.9 BCR (for SDR of 2.5)	Complete and updated (2008)	Missing
2	Betuwe Line (NL/DE)	ex-post	4 705	Payback per. 15-20 yr.	Simplified	Missing
3	Rail Baltica (PL/LT/LV/EE)	planning	3 540 AECOM study	1.75 BCR 9.3% EIRR 0.05% FIRR	Aggregate environm. assessment	Included in environmental assessment
4	Slovenia - Hungary part of rail corridor V	ex-post (PP6 under construct.)	203.3	EIRR ex post: 9.4% (HU) 8.2% (SI)	Not available	Missing
5	West Coast Main Line (WCML) (UK)	ex-post	12 444	2.4 BCR GBP 190/260 million NPV	Simplified	Missing
6	Fehmarn Belt Fixed Link (DK/DE)	planning	5 500	2.6 BCR	Underway	Included in EIA
7	Tunnels on SE40 Expressway Sevilla-Huelva (ES)	con-struction, (ex-post)	239 (525) (24 by TEN-T EERP)	6.04 to 6.54 BCR	Yes, as of year 2000	Missing
8	A11 motorway Berlin-Poland (DE/PL)	construction (ex-post)	131 (10 by TEN-T)	Missing	Complete for plan approval	Missing
9	Malpensa 2000 airport (IT)	ex-post	945 (27 by TEN-T)	Payback per. 7 yr., (CBA missing)	Incomplete, Focus noise, Updates	Missing
10	Seine- Scheldt waterway (FR/BE)	planning	5 900	5.3% EIRR (France)	Completed 2005 (Flanders) & 2006 (France)	Missing

BCR = Benefit-cost ratio, NPV = net-present value, EIRR = Economic Internal Rate of Return, SDR= Social Rate of Discount, FIRR = financial internal rate of return

Source: own elaboration

4.2.1. Brenner Base Tunnel

Timeline

The idea of the Brenner Base Tunnel (BBT) was revived in 1971 when the International Union of Railways (UIC) commissioned a study for a new railway line with a base tunnel. By 1989 three feasibility studies had been drawn up which formed the basis for further planning of the Brenner Base Tunnel. These feasibility studies were followed in 2000 by the

first traffic study by Prognos and then updated in 2005, 2007 and 2012 by ProgTrans. The first CBA conducted in 2004 by Ernst & Young was revised in 2007.

CBA and financial analysis

The revised 2007 CBA resulted in an economic internal rate of return of the project of 4.73%, with a total economic investment cost of EUR 6 billion; in a sensitivity test, assuming 25% higher construction costs, the EIRR drops to 3.91%.

EIA-SEA-Climate Assessment

In the framework of the BBT project, various EIAs were conducted. These studies include the evaluation of environmental criteria like noise, vibration, air, public health, geology, surface water and ground water, landscape, ecosystems, vegetation, agriculture and fauna.

Transparency of assessment – public availability

The 2007 CBA from Ernst & Young was not available to the public, but was available on request by BBT SE. The EIA and the traffic studies prior to 2012 are available on the World Wide Web.

Funding

The basic structure of the financing of this large-scale project is quite simple: the European Commission formally guaranteed a very high level of support for TEN-T priority project n° 1, with a grant of up to 20% of work. Austria and Italy will equally share the remaining costs. However, Austria and Italy hope that the EU will shoulder one third of the entire costs for the construction of the Brenner Base Tunnel.

Project specific issues

The basic idea of the 1987-1989 feasibility study for the Brenner Base Tunnel was a mixed transport system with a capacity of 400 trains per day with 80% freight trains. Examples of such base tunnels are the Swiss Lötschberg and the new Gotthard Tunnel, presently under construction. The BBT is being built for mixed traffic.

Conclusions to be drawn

- The Brenner Base Tunnel gains a high level of support from the European Commission for priority project PP1, with an earmarked 20% of the budget. The Brenner project is fully meeting EU objectives, confirmed by status of priority project and inclusion in TEN-T core network. BBT will be financed by the national budgets of Austria and Italy plus the TEN-T funding.
- Traffic analysis and forecasts were updated as needed.
- CBA of 2007 was the only one available.
- Financial analysis was not available.
- More transparency would be an asset.

4.2.2. Betuwe Line

Timeline

The initial impulse to build the Betuwe line between the Rotterdam harbour and the German border seemed to stem from a master plan for the future of the Port of Rotterdam in 1985. Instead of closing down the still existing parts of the line it was suggested renewing/building it as a dedicated rail freight line. In 1990 the Betuwe Line was recognised as part of a Dutch strategic transport network. However, in 1994 the project was put on hold. Supported by the report of the so-called Hermans Commission the project was revived in 1995, when the government also took the final decision to build the dedicated rail freight line. Construction of the part to be renewed started in 1997 and of the new section in 1998. The Betuwe Line commenced operations in 2007, though some

construction works on the cross-border section and in the area of the Port of Rotterdam is still ongoing today.

CBA and financial analysis

The economic analysis carried out in 1992 and 1993 concluded that the payback period would be 15 to 20 years. Some alternatives have been considered in a similar approximate way as the whole economic analysis. The Netherlands Court of Auditors in 2000 concluded that "a sound and comprehensive cost/benefit analysis of the Betuwe Route is still missing". The economic analysis was also fundamentally flawed, as it was based on an inappropriate transport demand forecast, which actually did not at all reflect the impact the Betuwe Line might have. An ex-post analysis is still missing.

EIA-SEA-Climate Assessment

In 2000 The Netherlands Court of Auditors also concluded that policy information on environmental benefits of the Betuwe Line was lacking. Environmental impacts only considered air pollution, while noise, safety and land use issues were neglected. However, the final design chosen for the Betuwe Line reveals that environmental and health concerns were taken into account by circumventing the 15 villages along the line, building 95 km of track parallel to the already existing motorway A15 and considering safety measures. Climate impacts were not assessed. An ex-post EIA seems to be underway, but details could not be obtained.

Transparency of assessment – public availability

The decision about the Betuwe Line caused intense public debate in The Netherlands. It is assumed that this was the case from the beginning when the planning started in 1990, but this cannot be confirmed. Nevertheless, today off-line there have been many forums on the internet and in newspapers discussing the Betuwe Line. Regular progress reports have been published, and both the Dutch parliament and the Court of Auditors held several debates or audits on the issue of the Betuwe Line. Reports on these government debates or at least summaries thereof can today still be obtained on the internet.

Funding

Though in 1990 it was originally envisaged to implement the whole project with private money, just the opposite was the case when the Betuwe Line was actually built. About 95% of funding came from the Dutch government. 4% were co-funded by the TEN-T budget as the Betuwe Line constitutes priority project 5 of the TEN-T networks.

Project-specific issues

The Betuwe Line constitutes a dedicated double track electrified rail freight line. It connects the Port of Rotterdam, one of Europe's biggest freight hubs with its Hinterland. The project provides the potential to carry out an excellent case study on the financial and economic output of a dedicated rail freight line. This would be important when it comes to future decisions on similar dedicated freight tracks in Europe.

Conclusions to be drawn

The Betuwe Line presents a prominent example of a political decision on a transport project, triggered by a stakeholder (i.e. the Port of Rotterdam). Of course, the project fitted in with strategic plans promoting the concept of "Mainports" in the Netherlands. But as an ex-post analysis is still missing,, it is too early to decide if the project was actually beneficial in socio-economic and financial terms. From the European perspective the project fits well into the strategic transport policy objectives as it promotes rail freight and makes it attractive for long-distance transport on major demand corridors connecting European freight/economic hubs. Also, from this point of view it is recommended that an ex-post

analysis should be carried out, considering that European funding is still being provided to complete the line.

4.2.3. Rail Baltica

Timeline

The Rail Baltica project includes the railway corridor between Warsaw and Tallinn with a maritime extension to Helsinki (TEN-T priority project PP27). Construction work can be started on the Polish side (standard gauge existing; upgrade to 160 km/h) while the project is, in our estimation, still premature for the northern part (wide gauge existing), in particular north of Kaunas. Two major studies have been elaborated which are entitled "feasibility studies" (COWI et al., 2007; AECOM, 2010). The two studies start from substantially different design parameters, routing of potential variants and station locations. For example, COWI et al. assume a design speed of 160/120 km/h and standard gauge only for one variant which appears financially doubtful. AECOM assumes a design speed for passenger trains of 240 km/h and a double track standard gauge. As the results of transport modelling and the following recommendations are completely different, careful analysis is needed before defining the final design parameters for a sound feasibility assessment.

For some sections detailed planning has been started, co-funded by EU TEN-T Programme (up to 50%) and reconstruction works on cross-border sections (up to 30%). Only the sections between the PL/LT border and Kaunas are compatible with the alignment favoured in the AECOM study ("red option") and selected for support by the Prime Ministers of Baltic States in Nov. 2011.

CBA and financial analysis

CBA and financial analysis is covered in both studies including the "mandatory" and environmental/safety CBA impacts. COWI calculated Benefit-cost ratios (BCR) of 1.9-2.8 with use of high value-of-time (VOT) and 1.1-1.7 with more realistic national VOT. Investment costs are between EUR 1 and 2.37 billion (basis 2006). AECOM assessed a BCR of 1.8 for the "best feasible option" requiring estimated investment costs of EUR 3.54 billion. The financial analysis shows for both studies that the project is not viable without EU co-finance. Assuming a co-finance of 60% COWI calculates a financial IRR between 2.6 and 4.7% for the different variants. AECOM calculates a financial IRR of 9.3% assuming 56.3% co-financing for total investment costs and 85% for priority axis.

EIA-SEA-Climate Assessment

Both studies include the evaluation of environmental criteria (air pollution) and climate footprint. They do not include a formal EIA or SEA.

Transparency of assessment – public availability

Both studies are publicly available and background information is given on request from the European Commission or the Baltic States' governments. While COWI applied methods which have been used also in other EU studies (in particular TEN-STAC) and are well documented, it is not easy to verify the set of assumptions for the AECOM study and to understand the model algorithms applied for modal split and assignment of traffic. Not all results seem plausible, in particular in regions with low population density (e.g. Estonia). Also the investment budget of EUR 3.54 billion for 728 km double track standard gauge railways with a design speed of 240 km/h seems to be most optimistic.

Funding

EU co-funding rates assumed are 60% (COWI) and 56.3%/85% (AECOM). Funding is expected from various EU sources (TEN-T/CEF, ERDF, CF).

Project-specific issues

Rail infrastructure is currently characterised by wide gauge tracks in the Baltic States and poor conditions in particular on the north-south axis. Changing to standard gauge implies a new line of 728 km length (favoured "red line option"). Passenger demand in northern sections is low. Freight demand is strong in East-West direction, linking Baltic sea ports with Belarus and Russia, but modest on the North-South corridor. Financially the project is not viable but it may provide high EU value added (not quantified in the studies).

Conclusions to be drawn

Although many documents are available the status of planning is not transparent. Two "feasibility studies" have been launched which may better be characterised as "pre-feasibility studies", analysing different alternatives for the alignment and yielding different results. Four fiches for preparing planning documents and technical design for sections of the Rail Baltica have been received from TEN-T EA which do not correspond to the favoured alignment in the recent feasibility study, which is also favoured by the governments of the Baltic States. According to the documents currently available Rail Baltica investment in the Baltic States can mean two different things: (1) Renewal and upgrade of existing wide gauge rail sections and (2) construction of a new standard gauge track, eventually with dual gauge sections. Against this background it is recommended:

- To develop a strategic transport (master) plan to integrate the various rail investment plans including Rail Baltica in a complete multi-modal network context, i.e. including the improvement of alternative transport modes;
- To revise the very optimistic demand figures in a network context, using an integrated multi-modal transport forecasting model;
- To prepare a revised CBA, as well as EIA (for the sections), SEA and CIA, based on a strategic plan for the development of the transport sector and its infrastructure;
- To prepare a regional economic impact analysis to quantify the European added value;
- To decide on a favoured final alignment with appropriate design parameters for the Rail Baltica main axis on the one hand and the development of the regional railway network on the other hand, including the interfaces with Rail Baltica, on the base of the above information; consider a staging of investments;
- To design the stations for the favoured option in a way that transfer of passengers is easy and without major delay; construct synchronised operation schedules with regional public transport lines (important because not all major cities can be linked directly to Rail Baltica);
- Develop a clear organisation for the multi-national project management, i.e. establish a project company – eventually starting from the existing Task Force - for final design, construction, finance and eventually the operation after completion of the project (DBFO or similar organisation);
- Develop a realistic financing scheme for the construction and operation phase including contributions of the operating company, EIB loans and state funding. The EU co-funding should be kept on a reasonable level below the maximum ERDF/CF co-funding rates because the main purpose of the Rail Baltica project is commercial.

4.2.4. Slovenia - Hungary section of rail corridor V

Timeline

The Pan-European (Helsinki) Transport Corridor n° V runs from Venice via Trieste, Ljubljana, Budapest to L'viv in Ukraine; following the accession of Hungary and Slovenia to the EU in 2004, the railway part of Corridor V became part of Priority Project n° 6. By that time, the cross-border railway section between Hungary and Slovenia (Murska Sobota–Hodoš–Bajánsenye–Zalalövő) had already been completed (in 2003). The main rationale for this project was at the time a direct railway link for passenger and freight trains, avoiding transit through Croatia. Our assessment focuses on this completed section as other rail projects on this corridor are still in a preliminary planning phase and virtually no documentation was accessible except a PHARE-funded strategic study on the Development of Corridor V and its branches with traffic forecasts and the identification of capacity bottlenecks up to 2020.

CBA and financial analysis

A feasibility study and a "cost efficiency study" had been carried out prior to construction. The reports were not available for review. An ex-post audit report, however, provides information regarding the economic efficiency indicators (EIRR, ENPV and dynamic time of return). These indicators have somewhat deteriorated during the investment implementation, because of increased investment costs. Economic feasibility indicators and financial costs are sufficiently well documented while parameter assumptions for the CBA are not.

EIA-SEA-Climate Assessment

The feasibility study from 1996 presented possible impacts of the railway construction and operation on the environment. Air quality, agricultural land, soil and preservation areas along with impacts caused by railway noise, impacts on natural and cultural heritage, flora and fauna were taken into account. The Audit Report provides a summary of the most important elements of analysis. Greenhouse gas emissions were not the subject of investigations at that time.

Transparency of assessment – public availability

Due to the fact that the project has already been completed for almost 10 years, it was difficult to find the original source documents besides the already-mentioned published Audit Report. The only recent documents obtained related to the planning of the electrification of the railway line Pragersko-Ormož-Murska Sobota-Hodoš-state border.

Funding

The investment realisation and the increased investment costs were financed by state budgets, bank loans and in addition an EU grant to Hungary from PHARE funds.

Conclusions to be drawn

As the focus of PP6 is on the Lyon-Turin rail link (a mega project) very little attention seems to be paid by the EC administration to the Eastern part of the rail corridor. An integrated strategic planning of the needs for a rail line upgrading on Hungarian and Slovenian territory is missing. The secretariat of the EU Co-ordinator for PP6 was not in a position to provide relevant documents.

4.2.5. West Coast Main Line (WCML)

Timeline

The West Coast Main Line (WCML) is actually a network of lines linking London and the Southeast of England to the second and third largest UK cities (Birmingham, Manchester), to Northern Wales, Cumbria and Scotland with a length of the line of about 1 100 km. Building the WCML dates back to the 1830s and the line regularly needed extensions, upgrades and renewals. These were either driven by deterioration of existing infrastructure and/or demand growth. Both were relevant drivers when in 1994 the feasibility study to upgrade the WCML was carried out. Work started in 1998. Due to immense cost overrun (nearly by a factor of 6 in 2002) and immature technology used, the upgrade project required a complete restart and redesign in 2002/2003, for which the decision was taken in 2003. This work was completed in 2008/2009. However, transport demand on WCML grew strongly so that several sections again operate at capacity limits, requiring a continued upgrading. As of 2012 a new high-speed rail project (HS2) is being discussed, providing extension for WCML as well as offering alternative routes for long-distance transport demand.

CBA and financial analysis

The feasibility study in 1994 was organised by the private operators of track and rail services (Railtrack and WCML Modernisation Development Company Limited, 1994). Thus it was confidential and rather focused on private rather than on socio-economic costs and benefits. A do-nothing option did not exist as the WCML urgently needed a renewal due to a lack of maintenance over many years. Options analysed by the CBA included three infrastructure renewal options, and four major upgrade options for future line speeds (175/200/225/250 km/h) linked with appropriate development of signalling/control technology and power supply. A BCR was not estimated. The "cheapest" infrastructure option (Core Investment Programme, CIP) was expected to generate a NPV of GBP 190 million for Railtrack and required track infrastructure investment of GBP 1 386 million (GBP 970 plus 416 million in 1994 values⁷). Train operators and users should obtain a NPV of GBP 260 million, where the quasi financial internal rate of return (IRR) was between 9.6% and 12.5%, of which the best option was to upgrade the WCML to maximum line speeds of 225 km/h using tilting trains. The whole study could be classified as early partial CBA, but mixes options, view points (track operator, service operator, users, other modes users) and clearly distinguished options.

In 2003 the study of the Strategic Rail Authority was much more precise and focused on the improvement of the infrastructure, signalling and power supply. Maximum speed target for renewal was reduced to 125 miles/h (201 km/h). Their cost estimate amounted to GBP 5 909 million (in 2002/03 prices, of which infrastructure was GBP 2 586 million, signalling 2 248 million, power supply 890 million). The BCR was estimated at 2.4 (Strategic Rail Authority 2003, Network Rail 2003).

EIA-SEA-Climate Assessment

The feasibility study in 1994 contained an EIA according legal requirements at that time. In general, it argued that impacts would be limited as the project was the renewal of an existing infrastructure. In a map-based exercise potential conflict areas with cultural heritage and nature heritage were identified. External costs to non-users of the rail or road (modal-shift) have not been assessed. Noise impacts have only been assessed concerning the freight options but not the faster and more frequent passenger trains. Carbon dioxide or greenhouse gas impacts have also not been estimated (Railtrack/WCML MDCL 1994).

The revised strategy for the WCML in 2003 was assessed based on five main criteria required by the Department for Transport (DfT) at that time. One of the criteria was environmental impact, including CO₂ emissions e.g. considering saved CO₂ due to modal-shift from road to rail (Strategic Rail Authority 2003). This approach already comes much closer to today's requirements of an EIA, though it still neglects the life-cycle impacts of infrastructure and vehicles (upstream and downstream).

Transparency of assessment – public availability

The Feasibility Study of 1994 was confidential, though it is public as of today. The reason was probably that at that time only private operators and private funding was involved and no requirement for transparency existed. The updated strategy of 2002/2003, an analysis of the House of Commons about planning mistakes of the WCML renewal and the ongoing debate on HS2 occurred with involvement of the public.

Funding

The plans for an upgrade of WCML in 1994 foresaw funding by the private operators only. Railtrack should have been able to fund the infrastructure investments from the track access charges, and the service operators would fund their investments from increased demand. The revised plan in 2003 involved full funding from the national budget apart from EUR 80 million that were provided from TEN-T funding (1.4%, TENtec Information System 2009).

Project-specific issues

The WCML does not constitute a new infrastructure development, but a maintenance and renewal project of one of the largest existing high demand rail lines in Europe. The drivers of the project were the urgent need for maintenance and renewal as well as capacity limitations. Specifically there was also the underestimation of growth in transport demand. While in 1994 the estimation was an increase in passenger transport carryings in the order of +5% to +22%, the revision in 2003 expected an increase of 15% to 25% due to the renewal. Actually the demand increased at a rate of above 10% annually, which was by far higher than the 3% forecast (National Audit Office 2006). Other sources even speak about a threefold increase of rail demand between 2000 and 2010 compared with a twofold increase expected in 2003 (personal communication).

Conclusions to be drawn

Intransparent private planning under shareholder-value driven funding constraints led to a financial disaster of the first plan for renewal from 1994. Supported by the revised strategic transport policy of the UK in the years 1998-2000 the overall capital investment for transport should be increased by 75% between 2000 and 2010 with rail attracting about half of all investments to achieve a 50% increase in rail passenger demand (pkm) and 80% increase in rail freight (DETR 2000). The strategy backed the revision of the WCML renewal strategy in 2003 by increasing investments, setting clear targets, developing and assessing detailed plans against status quo seriously, involving stakeholders including industry and funding the project by public money, which opened the door for transparency about costs and planning.

⁷ These values were not converted into Euro to avoid distortions due to the significant variations of exchange rates and inflation rates over the past 18 years.

4.2.6. Fehmarn Belt Fixed Link

Timeline

The implementation of the Fehmarn Belt Fixed Link has been a commitment of the Danish government since the signing of the agreement with Sweden in 1991 to build the Oeresund fixed link, one of the most successful large-scale TEN-T projects. Technical, environmental and economic studies were carried out in 1999 followed by an enquiry of commercial interest to implement the Fehmarn Belt fixed link as a PPP project. In the end, Denmark assumed full responsibility in a treaty signed with the German Government to finance, build and operate the Fehmarn Belt Fixed Link. The project was submitted for EU co-financing under the TEN-T 2007-2013 cycle and approved as one of the Priority Projects (n°20) and is now part of the proposed EU transport core network. The project is still in the planning phase. The project planning agency, Femern A/S, a subsidiary of Sund & Baelte, is the organisation that was in charge of the implementation of the Størebelt and the Oeresund project on behalf of Denmark. Femern thus can draw on the experience of two major European fixed link projects; this is not only relevant for the implementation phase but also very much so for the still ongoing planning phase. At present, studies are underway for the approval of the project in 2013 by the Danish Parliament, which will also decide whether to go for the preferred technical solution of an immersed rail/road tunnel or any other technical solution. The project also requires approval from the German side. Construction is expected to start in 2015 with the fixed link becoming operational in 2021.

CBA

A first CBA had been carried out in 1999 as part of a joint Danish-German feasibility study on the basis of appropriate technical and traffic studies. Benefit-cost ratios varied between 0.84 (EIRR: 2.2%) for a bored railway tunnel and 2.6 (EIRR: 7.8%) for an immersed combined rail (2 tracks) and road (2x2 lanes) tunnel. A new Danish assessment in 2004 confirmed the earlier assessment, calculating an EIRR of 6.9%. No further CBA has been ordered since.

EIA – SEA – Climate Impact Assessment

An EIA in accordance with EU legislation is underway and should be completed in 2013 for submission to the Danish Parliament for the final approval of the project. The EIA will also cover the climate impact.

Transparency of assessment – public availability

Femern A/S provides full transparency of technical, environmental and economic aspects by allowing accessibility on the internet of all studies and other relevant documents over the past 15 years. This level of transparency is unique.

Funding

The final engineering of project funding has not yet been firmly decided by the Danish government. Construction funds will be raised in private capital markets. The Danish State will guarantee loans and bonds as well as equity of the implementing body, most likely Femern A/S. The Danish National Bank will be on stand-by to complement private funding if insufficient. In the longer term, revenues from the usage of the fixed link are now expected to pay back all debts in a period of 39 years according to current estimates. According to the most recent assessment, the investment costs will amount to EUR 5.5 billion, up from EUR 3.8 billion in 1999. Inflation accounts for 35% of the price escalation. Furthermore, there have been changes in the design of the tunnel, partly responding to changed legal and safety requirements. And finally, the planning phase that was originally assumed to last three years will now be at least six years.

Conclusions to be drawn

- The project fully meets EU objectives, confirmed by its status of priority project and inclusion in the TEN-T core network.
- There is a strong commitment by the Danish government to implement the Fehmarn Belt fixed link. The executing agency (Femern A/S, a subsidiary of Sund & Baelte) has (access to) the experience in implementing similar large-scale infrastructure projects (Great Belt and Oeresund fixed links).
- The project is planned to be re-financed from road toll and track charge revenues. Investment funding will essentially be private, although with Danish government guarantees.
- Femern A/S allows full transparency by making all relevant documentation available on the internet for download.
- The technical solution has not yet been decided, which renders the environmental assessment rather complex.
- The escalation of investment costs by 45% between 1999 and 2011 is not unreasonably high.
- Traffic and feasibility studies have been carried out twice (in 1999 and 2004) but in view of the economic turmoil in the past five years, a new assessment (CBA) would be necessary, in particular against the background of changed transport forecasts.

4.2.7. SE-40 Expressway Sevilla-Huelva – two tunnels at Dos Hermanas

Timeline

The project is part of the longer road link Cordoba-Seville-Huelva that in turn forms part of priority project 8. SE-40 constitutes a ring road around Seville. The funded project analysed concerns the construction of two tunnels of a length of 2.76 km and 4.14 km on this ring road southwest of Seville. In narrow terms this section would not have been part of priority project 8, which passes Seville on the northwest, while the project is located in the southwest of Seville. However, the project is assumed to provide a bypass around Seville on PP8 and the TEN-T funding provided for the construction of the two tunnels comes from the European Economic Recovery Plan (EERP), i.e. the economic stimulus package that was defined in 2009 to mitigate the economic crisis of the years 2008/09. In that sense the project fulfilled the funding criteria, as it seemed sufficiently mature to expect that the money would be spent during 2009 and 2010. Nevertheless, it seems that construction is significantly delayed (Giorgi 2011, p.53) or even completely on hold.

CBA

Two cost-benefit analyses have been provided by the Spanish Authorities. One concerned the SE-40 northwest section of the ring road between the two motorway connections, one to Huelva (direction west) and the other to Cordoba (direction north-east). Improving this northern part of the ring road would generate a substantial benefit with a benefit-cost ratio of 6.36 and an internal rate of return of 26.31% over a period of 20 years applying a discount rate of 3.5%. This CBA also considered the traffic on the upgraded southern part of SE-40. The second cost-benefit analysis also provided figures for the two tunnel sections. The six different options generated benefit-cost ratios between 6.04 and 6.54.

EIA – SEA – Climate Impact Assessment

An EIA in accordance with Spanish legislation and presumably also EU legislation was carried out, probably in 1999. The EIA analysed and recommended compensation measures for adverse environmental impacts. Issues addressed include air pollution, hydrology,

geology, climatic conditions, impacts on flora, fauna, health and territorial planning, cultural heritage, nature and landscape. Impacts on greenhouse gas emissions were not considered.

Transparency of assessment – public availability

The analysed documents on CBA, financial analysis and EIA have been provided by the Spanish Authorities at our request. There seems to be some debate in the Spanish newspapers on the project, but we could not identify the way public participation was ensured.

Funding

90% of the project costs of EUR 239 million are funded by national budget and 10% by TEN-T funding (EUR 24 million) the latter provided under the European Economic Recovery Plan (EERP). The TEN-T website reports that the project has been completed, while the TEN-T EERP website reports that the project is on hold due to further checks of environmental laws. The website of the State Company for Land Transport Infrastructure (SEITT) as of the end of 2012 lists two tunnel projects on the southern section of SE-40 with a budget of altogether EUR 525 million. According to SEITT both projects are still under execution.

Project-specific issues

The project receives a specific TEN-T funding from the EERP call. However, the status of implementation is unclear. Actually the project was selected for this study because the TEN-T EA website indicated that it has been completed, which would have allowed for ex-post analysis. However, it seems that either the project is ongoing or has not yet even started, as other websites indicate.

Conclusions to be drawn

This case is interesting as specific conditions concerning maturity have led to the selection of the project for TEN-T funding by the EERP call. Nevertheless, it seems that the files provided to the EC to prove maturity were insufficient, as project progress seems much slower than expected, if any progress at all has been made. Further, the monitoring of the project at the TEN-T EA provides contradictory messages stating on the one hand that the project was completed in 2010, though on the other hand it is reported that pending issues related to environmental law have to be resolved before funding is provided, while Spanish news sources report that the project has been temporarily stopped since mid- 2010 and discussions on its completion or redesign were ongoing at least until June 2012.

4.2.8. A11 Berlin-Poland motorway

Timeline

The A11 motorway dates back to the 1930s connecting Berlin with Szczecin in Poland. Today the part from Berlin to the Polish border constitutes the motorway A11 in Germany. The A11 forms part of the European Highway E28 that connects Germany via Poland to the Baltic States. After the German reunification in 1990 the German government defined the so-called "Verkehrsprojekte Deutsche Einheit" (VDE) (transport projects to implement German reunification), of which a large part was to renew poorly maintained existing transport infrastructure, and, where necessary, increase capacity to accommodate the expected transport growth between Western and Eastern Germany, and beyond towards the neighbouring Eastern countries. The latter became an even higher priority after the decision that neighbouring Eastern countries would accede to the EU. Since 1996 the A11 is being continuously renewed, but even until 2007 there have been sections, which still were constructed using the concrete slabs from the 1930s. Completion of the renewal, building

new pavements, adding emergency lanes, re-constructing all bridges and adding new bridges including green bridges allowing animal crossings is expected to last until 2014.

CBA

The "Verkehrsprojekte Deutsche Einheit" (VDE), which comprised 17 projects to re-establish the transport connections between West and East Germany (9 rail projects, 7 road projects and one inland waterway project), were decided within a period of 6 months between October 3rd 1990 and April 9th 1991. The projects were a political decision to react to the fast and unexpected German reunification process. Therefore a CBA was not applied. During these 6 months the initial cost estimate for the 7 road projects was about EUR 12 billion. Until the near completion of the projects in 2010 the cost increased by about 40% to EUR 16.6 billion, in particular due to construction of tunnels additionally required in hilly areas (DEGES 2011). However, though for the basic decision to build the VDE projects no CBA was required, for the decision on exact routes CBA or financial analysis was conducted. The part of the A11 receiving funding from TEN-T was built between 2000 and 2010 at a total cost of EUR 131.5 million supported by a TEN-T budget of EUR 10 million.

EIA – SEA – Climate Impact Assessment

The plan approval procedure for A11 was split into five sections, for which we obtained the EIA, and a remaining part of about 20 km length for which we did not obtain an EIA. The EIAs considered impacts on water, soil, climatic conditions, flora and fauna, nature and landscape. Two patterns can be observed for the assessment of the different sections: on the one hand the impacts were assessed as less dramatic since construction of the A11 in the 1930s had already led to impacts on and a separation of the living space on both sides of it. On the other hand the areas crossed by the A11 are sparsely populated and several sites of ecologic importance have been identified and mitigation measures needed to be considered. Greenhouse gas emissions were not estimated at all.

Transparency of assessment – public availability

There have been intense discussions about other projects of the VDE, i.e. motorway A 20 that was a new construction project. Related documents were largely public. However, since A 11 mainly concerned renewal instead of new construction, documentation either consists of underpinning studies that are not publicly available or do not exist.

Funding

Funding is provided from national budget of the Ministry of Transport and the TEN-T funding (EUR 10 million). It seems that the overall national funding is higher than reported in the TEN-T fiche of the project, which indicates an implementation period of 2000 to 2010, while national sources suggest a project period from 1996 until 2014. German budget regulation seems incompatible with TEN-T funding procedure, regarding the decision process: first the project financing from national sources has to be secured for the whole budget and then subsequently the TEN-T funding can be applied for. This means that the condition that TEN-T funding should be required to go ahead with the project can never be met.

Project-specific issues

Like the WCML the A 11 motorway constitutes a case in which an existing infrastructure required very substantial renewal, which included completely rebuilding part of the route, selected bridges and adding emergency lanes. Thus planning choices concerning the specification and selection of an optimal route were not applicable.

Conclusions to be drawn

The decision to implement the project was taken at the political level after the German reunification in 1990, accelerating the normal planning procedures. Public availability of studies is limited. This seems due to the fact that the project is basically a renewal of an existing infrastructure. It should be analysed, if for cases of infrastructure renewal as opposed to new construction different rules e.g. in terms of CBA or transparency should apply. At the moment this seems to be the case.

4.2.9. Malpensa 2000 airport

Timeline

First ideas to extend the airport system in Milan dated back to the 1970s. However, only with the publication of an airport master plan by the airport operator (SEA, Società Esercizi Aeroportuali) in 1985 did the project gain momentum. In 1986 it became part of the General Transport Plan of Italy and in 1987 it was finally approved by the Italian Transport Ministry. Construction at the former mixed military and private airport of Malpensa started in 1990 and was completed in 1998. Within a few years after opening transport demand exceeded the ex-ante transport forecast. However, access by public transport or facilities for freight transport were not planned in an integrated way from the beginning, so that extensions and improvements of these infrastructures are ongoing today.

CBA and financial analysis

We could not identify a publicly available CBA. However, it seems that both SEA and the EIB performed a CBA. Beria/Scholz (2010) point out that if a public CBA had existed the private funding could have been higher and the public funding lower, as the profitability of the airport would have been evident.

EIA-SEA-Climate Assessment

Several EIAs have been carried out, though two of them only during the phase of construction. The EIAs seem to have focused on noise impacts and would have been insufficient according to today's EIA guideline. We could not find any indication that climate impacts have been considered and assessed.

Transparency of assessment – public availability

It is likely that ex-ante assessments of Malpensa airport were not publicly available. Furthermore, the objectives of building the airport and developing the whole Milan airport system (e.g. replacing Linate by Malpensa vs. using Malpensa as global hub and Linate as a city airport) were either not clearly expressed or were changing over time. Thus public acceptance by residents close to the new airport was limited and some opposition emerged at both airports.

Funding

The private operator funded roughly 18%, the EIB another 33% so that these sources amount to about half of the funding. The public funding came from national budget (46%) and TEN-T budget (3%). A higher share of private funding seems to have been feasible. The actual investment cost remained below the ex-ante cost assessment (about 5%).

Project-specific issues

Malpensa airport construction started earlier than all other case studies looked at in this project. Actually, the project was decided before it became part of the TEN-T priority projects. Therefore it seems that the decision process lacked some elements required today (e.g. complete EIA, transparency and public participation at early stages).

Conclusions to be drawn

Planning and approval of Malpensa airport were performed in a fast way. Investment cost remained below the ex-ante estimates and transport demand exceeded the ex-ante expectations. All these points suggest that this project is an example of good planning practice. A large part of the success is due to the dynamic development of air transport in general. The project could possibly even have been more successful in financial and economic terms if a higher financial responsibility had been allocated to the private sector. Better integration of planning (e.g. of access by public transport) and design of proper alternatives for co-ordinated services by both Linate and Malpensa airports would have been tasks in the public domain.

4.2.10. Seine-Scheldt waterway

Timeline

TEN-T Priority Project 30 consists of several projects in France and in Belgium that are planned and implemented parallel to each other, with different successive coordinating fora (the Seine-Scheldt committee in November 2005, followed by an Intergovernmental Conference in September 2009; the operational side was entrusted to a European Economic Interest Grouping in early 2010). They were presented by the two governments in 2004 for partial TEN-T co-funding. An EEIG was set up for the implementation of the programme. Our assessment focuses on the Seine-Scheldt priority project in France, which is in itself a large-scale project with a now estimated total cost of EUR 5.9 billion - including EUR 4.3 billion for the Seine-Nord Canal itself. The project planning follows French government procedures established for large-scale infrastructure projects. Public hearings (Débat Publique) were held in 1993/94. Technical, economic and environmental studies were carried out prior to the enquiry in early 2007 for the Declaration of Public Interest, which became effective by the end of 2008. The construction of the canal shall be awarded to a Public-Private Partnership which is presently up for tender. It is still unclear when construction will be started and completed.

CBA

Traffic study and cost-benefit analysis were carried out in 2006. For our assessment, we had available a summary document which was, however, not detailed enough for our purposes. Traffic forecasts were based on a toll level of 2.5 Euro/tonne. The CBA assumed a EU grant contribution of 19% which was deducted from project costs. Various options of financial engineering investigated make it difficult to determine the suitable EIRR value from a range between 4 and 7%. The central base value is 5.2%. According to VNF, a complementary study was carried out and approved by the EEIG in 2010 to define more precisely the expected impacts of the project, focused on French territories. The whole impacts (growth, traffic, added value) were updated, but again, the relevant documents were not made available to us for review.

EIA – SEA – Climate Impact Assessment.

A project of the size of the Seine-Nord Europe canal requires a detailed EIA under EU legislation. We assume that the relevant documents were submitted for EU grant approval from the TEN-T 2007-2013 budget but only a summary document was available to us. We are uncertain whether or not the CBA of 2006 was updated at any time. Two CIAs (water usage and CO₂ impact) were carried out; still, dedicated CIA is not compulsory under French law.

Transparency of assessment – public availability

Besides a few of the documents for the Enquiry prior to declaration of public interest and published on a dedicated website, partly with English translations and a number of public

relations documents, no documents relevant for a proper assessment are publicly available. VNF, the leading party in the EEIG, has commented on our draft assessment but did not supply the relevant documents in English; in keeping with French legislation, however, more comprehensive documentation following a public inquiry of 2007 is available upon substantiated request. Most recent documentation is not available, citing confidentiality requirements in competitive procedures, making for a mixed general impression of transparency in terms of public access to relevant documentation.

Funding

The canal project is still in the planning stage and hence the financial engineering of the project is still uncertain. The project includes a major PPP component, up for tender right now, and private investments in port and combined transport facilities. An EU contribution of 20-30% is expected.

Project-specific issues

We have not been able to get a direct contact with the Walloon authorities regarding the project components in their jurisdiction. We have established a contact with the Flemish partners in the EEIG but have not been able to obtain the proper documentation for assessment of the Upper Scheldt upgrading programme. The French part of the programme is presently under review by a governmental audit committee put in place by the new government administration in view of budgetary constraints; the audit report is due within the coming weeks; the fate of the project is in the balance. It should be mentioned that the French government has established very clear and binding procedures for the approval of large infrastructure projects which take into account EU legislation.

Conclusions to be drawn

- The uncertainty regarding the French canal project has not yet been resolved. The limitations regarding additional government debt may largely affect the Seine-Scheldt project, independently of the economic interest of the project for France and for Europe.
- If the Seine-Nord Europe canal should be abandoned or postponed, the economics of the Belgian programme components will also be in jeopardy.
- The French planning procedures for large-scale infrastructure projects are compulsory. The impression of transparency of traffic, environmental, economic and financial assessment is low. However, the French government has initiated additional feasibility / financial studies of the project, presently ongoing, and their final results are likely to carry considerable weight for the evolution of the project.

4.2.11. Summary conclusions from the case studies

The issues identified in the case studies confirm the broad picture of potential shortcomings of decision-making on large projects as summarised by this study in previous sections (see section 3.4 and Figure 2). Basically we would distinguish between cases that enable ex-post analyses and those cases that are still in a planning process and are suitable for a descriptive analysis of the quality of ex-ante studies and the planning process.

Six cases are earmarked by TEN-T EA as completed and are thus candidates for ex-post analysis (see Table 6). The most important question to answer in the context of this study is: were the cost estimates correct? And what helped that the decision to implement the project was based on the correct cost estimates? To deal with these questions Table 6 indicates cost estimates for three points of time:

- **Initial cost:** provides the first available cost estimate of the process that finally led to the implementation of the project. Often this cost estimate is produced years before the actual funding decision is taken, and thus has not been relevant for the funding decision. However, in other cases exactly that figure could have kicked-off a process of project planning and implementation that could no longer be reversed. In that sense a decision of general principle was taken based on such preliminary cost estimates that left realistic alternative options – including the do-nothing option – in the dark.
- **Cost at decision:** provides the cost estimate on which the decision to implement the project in its state analysed by the case study was taken.
- **Actual cost:** is the ex-post investment cost as reported in official documents, most often the European Commission TENtec system, but as well from national reports or reports of the infrastructure promoters.

When interpreting the figures in Table 6 one should take into account that several difficulties exist when comparing them.. In particular, some of the figures date back to the 1980s and were provided in national currencies (e.g. GBP, ITL), which requires converting them and taking into consideration exchange rates varying over a long period of time as well as inflation. Further, the infrastructure elements included in the three cost estimations may differ. Our figures are prepared to be as comparative as possible given the often missing information in the sources.

We identified two projects for which the cost estimates were appropriate at the time of decision and start of work, when the actual cost was in the range of -5% to 5% compared with the estimated cost at decision: Malpensa 2000 airport and WCML (this refers to the decision taken in 2003). However, WCML has to be treated with care, as we will explain later. Two other cases report a cost increase of +27% and +52% during the construction work (Betuwe Line and Rail section Slovenia – Hungary). The other two cases caused another kind of difficulty: though the TEN-T EA website reported that the projects are completed and thus we selected them for our ex-post case studies, it seems that neither project has yet been completed. In the case of the A11 motorway, most sections seem to have been renewed/upgraded and only on two final sections at both ends of the motorway implementation does work seem to be continuing, with a target to complete the works by 2014, but still being subject to the restriction of a limited budget of German infrastructure funds. In the case of the SE40 expressway the information is even more contradictory. The TEN-T EA website provides two opposing statements, one claiming that the work was completed in 2010, and another one that the work is pending, due to improvements of the EIA. The Spanish Authorities report on their website that the project works are ongoing, while Spanish news sources reported in 2012 about ongoing debates to stop or redesign the project, which according to some sources has been on hold since mid-2010. In both cases, we understand that the projects have not been completed and thus an ex-post analysis is not yet possible.

Table 6: Overview of the findings of the ex-post case studies

No	Selected TEN-T projects for ex-post analysis	Status	Initial cost EUR million	Cost at decision EUR million	Actual Cost EUR million	Cost overrun EUR million	Cost overrun %
2	Betuwe Line	completed	1 500	3 670	4 705 (197 by TEN-T)	1 035 (984) ⁽¹⁾	27%
4	Slovenia - Hungary section of rail corridor V	completed (PP6 under construct.)	(133.7)	(133.7)	203.3 (10 by PHARE fund)	69.9	52%
5	West Coast Main Line (WCML)	completed (follow-up)	2 460 ⁽²⁾	11 865 ⁽²⁾	12 444 ⁽²⁾ (80 by TEN-T)	579	5%
7	Tunnels on SE40 Expressway Sevilla-Huelva	not completed		(525)	(24 by TEN-T EERP)	n.a.	n.a.
8	A11 motorway Berlin-Poland	not completed		(131)	(10 by TEN-T)	n.a.	(40%) ⁽³⁾
9	Malpensa 2000 airport	completed	(248) ⁽⁴⁾	990 (483) ⁽⁴⁾	945 (27 by TEN-T)	- 45 (saving)	-5%

(1) Considering inflation

(2) Figures converted from GBP to EUR using 2006 prices and exchange rates (1.447 EUR/GBP)

(3) Figure refers to the total of road projects as part of the German Verkehrsprojekte Deutsche Einheit

(4) Contribution by the Italian government converted by fixed exchange rate (1 936 ITL/EUR)

Source: own elaboration

A general observation in the ex-post case studies concerns either the complete lack of examination of alternative options or the limited consideration of options, often only looking at slight variations of the basic preferred option. In our basic decision process (see Figure 2) this would be translated into the lack of a meaningful pre-feasibility study analysing the basically different options. On this issue, one also needs to differentiate between the large projects that focus on building a new infrastructure (e.g. Betuwe Line) and those that focus on renewal and modernisation of an existing infrastructure (e.g. WCML, A11 motorway). In the case of renewal projects, basic options could comprise design parameters (e.g. maximum train speed of 200 km/ or 250 km/h, etc.) instead of discussing e.g. a new tunnel, a new bridge or combinations thereof.

Though optimism bias often leads to overestimation of transport demand (see e.g. Flyvberg 2008) in our case studies we identified two cases, which significantly underestimated the future transport demand: the WCML and Malpensa 2000 airport. Interestingly, these cases include both a public project and a private project. This confirms the finding that transport forecasts underpinning transport projects in the EU reveal both over- and underestimations of future transport demand expressed elsewhere in this report (see section 4.6 and EIB 2003).

Concerning the transparency of developing and deciding about projects, our basic hypothesis was that public projects are more transparent than projects promoted by private investors. Though it is basically true that in the case of private funding - including funding by bank loans - it was impossible to obtain the studies carried out by the financing institutions (e.g. EIB), our analysis could not confirm the general truth of the hypothesis. Instead we would argue that transparency is important in both cases and will improve the project outcomes, both in terms of socio-economic and financial viability. This should be highlighted by the two most positive examples of our case studies: the WCML funding decision in 2003 and the ongoing decision about the Fehmarn Belt Fixed Link. Renewing the WCML was decided in two steps: first in 1994/1996 the decision was prepared by a private operator providing documents that were confidential to the public and obviously were flawed. The project was started and between 1996 and 2002 the cost increased sevenfold. When this was recognised, the project was reset and redesigned under the control of a public entity, Network Rail, which was closely supervised by the UK Transport Ministry and UK Auditors as well as Network Rail, who regularly published their plans and progress reports on the WCML planning and implementation. During this largely public process starting in 2002, the cost of the WCML dropped by 45%, and the actual cost when the project was completed in 2008 remained very close to the cost estimate of 2003 (less than 5% increase). In particular, this was possible as planning the WCML renewal was built on a detailed database reporting the state of the 1100 km long WCML. In other words, planning the details of construction works properly and prior to starting the construction was taken seriously. That is the major lesson to be learnt: it is possible to plan mega-projects accurately in advance and to take a decision based on an accurate and transparent plan. Of course, this comes at a cost and some sources speak of planning costs of 15% for today's large projects. However, this seems justified when it leads to the selection of the right project and the implementation of the most beneficial solutions. Therefore we would deem the Fehmarn Belt Fixed Link project as the other positive case study, as it considered both a broad range of options as well publishing its underpinning studies widely. This should encourage a debate aimed at improving the project and selecting the best solution while, of course, still including the do-nothing solution.

In general, it seems favourable that a dedicated project promoter is involved to provide continuous support to the development process of a large project and to improve the assessment of the project. The recent examples of ex-ante studies (in particular Fehmarn Belt Fixed Link and to some extent Brenner Base Tunnel) reveal that such project promoters are beginning to appreciate the benefits of transparency (e.g. no need to add costly environmental mitigation measures at a late step in the project, financial assessment on the base of accurate cost estimation) and are thus entering into a dialogue with the interested public at an early stage. However, not all project promoters of today's large projects seem to have learned this lesson.

The Rail Baltica project underlines the transparency issues. Although many documents are available, their relevance is unclear. Two studies exist which are ambitiously entitled "feasibility studies" although they analyse a wide range of alternatives with different assumptions, methods and results. The alternative which is favoured according to a political decision by the governments of Baltic States of 2011 does not correspond to the sections which are considered for upgrades and for which planning is co-funded by the EU. The major conclusion to be drawn from this project is that large-scale projects should be embedded in a long-term strategic plan for the Member States concerned, which includes all transport modes and their planned core networks.

4.3. TEN-T funding application procedure and documentation

The European Court of Auditors (ECA) explains that complex application forms need to be filled in to apply for TEN-T co-funding before 2005 (ECA 2006). In response to the ECA, the European Commission simplified the forms. The Guide for Applicants (version 1) from 2007 allows to highlight which information is actually requested from applicants (see European Commission 2007a). The following bullets are brief excerpts quoted from the 60-page document "Guide for Applicants (version 1)":

- 7.11 Financial performance of the Project: Please give the results of the Cost-Benefit Analysis with regard to the following indicators (p.41):
 - INTERNAL RATE OF RETURN IRR
 - NET PRESENT VALUE NPV
- 9.1 Please give information on ex ante evaluations of the Project and present the summary of main results (p.43-44).
 - ✓ With the exception of feasibility studies including amongst their activities an evaluation, all proposals must have previously been subjected to some evaluation. Please refer to them...
 - ✓ Provide a summary of the demand analysis, including the predicted utilisation rate on completion and the demand growth rate...
 - ✓ Outline the alternative options considered...
- 9.3 Please describe findings and results of the socio-economic analysis for the Project (p.44)....
- 9.4 Please give results and conclusions of any environmental assessment or study for the Project (p.44)...
- 9.6 Please describe the expected impact of the Project on traffic growth, multimodal split and safety (p.44)
 - ✓ It is strongly recommended to make use of existing studies. If such studies could have a relevant added value, please explain why they are missing...
- 9.8 As far as quantitative results are concerned and a Social Cost Benefit Analysis (SCBA) has been completed, please provide at least two of the following indicators, specifying values used for the calculation of the quantitative data (contingent valuation, travel costs, hedonic pricing, dose-response functions, shadow projects, replacement costs, value of time saved, of environmental gains etc.) (p.45):
 - INTERNAL RATE OF RETURN IRR
 - NET PRESENT VALUE NPV
 - BENEFIT/COST RATIO B/C...

Obviously, at least since 2007 the European Commission has been requesting applicants to deliver summaries of the information required by our study, if not complete studies. The Guide for Applicants from 2009 explicitly requests that studies shall be attached to the application so that the European Commission should have at least some of them for more recent projects on their premises or databases.⁸ However, all our requests to the European

⁸ «Describe the results of any previous or ongoing feasibility or technical studies undertaken for the Action (and, if applicable, for the Global project) and attach these in the annex. » (European Commission 2009b, p.39).

Commission (precisely TEN-T EA, DG MOVE and DG REGIO, see section 4.1) to obtain such studies related to the selected case studies failed. Several respondents informed us that such studies (precisely ex-ante cost-benefit / economic studies, transport impact studies, financial studies, environmental studies as well as detailed ex-post studies on single projects) did not exist at the European Commission. In a few cases, we were directed to publicly available studies. Nevertheless, a number of staff at the European Commission supported our project by very kindly being available for interviews via phone or face-to-face even during a period of extremely high workload (e.g. due to TEN-T days).

4.4. Planning cost increases vs. implementation cost increases

Increases in investment costs for new infrastructures may occur at two different points in time:

- **Planning phase:** during the planning phase amendment of plans may occur for good reasons e.g. due to adapting to transport needs or to fulfilling environmental requirements of EIA or SEA. In general, such amendments will also modify the cost estimates and could also alter the cost-benefit analysis or the financial analysis from both sides i.e. the cost side as explained above as well as the benefit side due to modified transport benefits or environmental benefits. In the ideal planning phase any such modifications are detected during planning and the plan is improved accordingly. The funding decision is then taken on the base of the final elaborated plan. Thus costs would not change during implementation due to internal project causes.
- **Implementation phase:** this phase starts with the implementation decision based on the final plan and an associated financing plan. During project implementation further cost increases should not occur, or should have been covered by appropriate risk management that avoids cost overruns of the planned budget.

This means: cost increase during the planning phase should be seen as a normal part of the planning process, indicating that further details of the project are taken into account, appropriately improving the planning and that a funding decision will be based on better understanding of the project. On the contrary, cost increase during implementation is a negative signal indicating that planning was insufficient and that the funding decision might have been taken on the wrong grounds.

Two recommendations could further improve the outcome of the planning and decision phase: first, adding a risk premium to the estimated cost considering both reference classes of risks and the probability that cost increase remains below the planned cost including the risk premium (e.g. for rail project a risk premium of 40% would be added to remain below this total cost with a probability of 50%) (Flyvberg 2008), and second to not only rely on one ex-ante study (in particular transport forecast and CBA), but on several produced by different stakeholders (Flyvberg 2009). Of course, our recommendation of transparency of studies is required for all of those so that their outcomes can be compared and validated independently.

4.5. Transparency of assessment may depend on funding structure

The opportunity to provide transparent access to ex-ante and ex-post documents concerning a project should be highest if public funding constitutes the only financial source. However, this is not always the case as there are manifold possibilities for influencing the procurement process by political interventions which are not reported and by allocating costs to different budget accounts. Furthermore, current monitoring and ex post evaluations are exceptions rather than the rule. Partly private operators – depending on their legal status - publish periodical data on the project success in terms of patronage, revenues or profits. But transparency problems also arise with private financial and management participation. The processes of construction, finance and operation management, i.e. the input side of the production process, are confidential and hard to control by the public (e.g. by public auditors). Even publicly funded and owned infrastructure projects may require confidentiality when operations of the infrastructure (e.g.: pricing of traffic) are granted in a bidding process and disclosing certain information would affect a bidding process, though the same information would be relevant for the public.

However, transparency for the public is also required in the case of involvement of both public and private money, at least through structured summary reports on the outcome of assessments. The structure of such summary reports would need to be defined and should at least include the benefit-cost ratio, the environmental (dis-)benefits divided by major categories, accident (dis-)benefits and climate impact (dis-)benefits. Public contribution to funding, discount rate, assessment time horizon and the total investment should be published as well. Further important framework conditions like GDP growth and population growth should be included as well as changes in transport demand, possibly as a percentage change to a baseline not to disclose the basis for the financial calculations. In the case of the granting of concessions, this could be made part of the contract.

4.6. Ex-post analysis of TEN-T

Ex-post analysis, though often promoted as an important tool to manage and steer projects, is rarely undertaken. Ex-post analysis would mean comparing the key elements of a project proposal with the ex-post situation, when the project has been implemented and has been operating for a few years. This makes it possible to compare the forecast of transport demand, transport revenues, environmental impacts and finally benefit-cost ratios or financial forecast (e.g. internal rate of return) with the actual measured impacts.

On the level of individual priority projects or corridors not many ex-post analyses exist, though for comprehensive funding programmes such as the TEN-T, of DG Regio funding for TEN-T and of EIB funding for Accession countries can be identified. The TEN-T Multi-Annual Programme 2001 to 2006 was made subject to an ex-post analysis. 48 projects were selected for assessment, 36 of them provided a table on the profitability of the project, only 11 of them actually provided a measure of economic or financial viability of their project (Deloitte 2007, p. 72). 8 projects estimated an internal rate of return between 0.95% and 10.2%, and 4 projects estimated benefit-cost ratios between 1.3 and 2.7. The authors conclude that this low availability of ex-post profitability indicators reveals that a culture for defining and measuring clear profitability indicators is not established. The lack of such profitability indicators on TEN-T projects was making it difficult to draw conclusions about the efficiency of TEN-T funding.

Also, funding from DG Regio for transport projects has been subject to ex-post analyses, both for studying in detail the methodology and benefits of ex-post analysis, which recommended ex-post CBA as an important tool for understanding project outcomes and ex-ante CBA as a facilitator of public debate (CSIL/DKM 2012) and for assessing the funding of the ERDF for transport over the period 2000 to 2006 (Steer Davies Gleave 2010). They observe that in the period 2000 to 2006 EUR 920 billion were spent on transport infrastructure in Europe, of which about 3% is funded by the ERDF (EUR 25.4 billion). They recommend that the funding threshold above which a CBA has to be performed to receive ERDF funds should be lowered from EUR 50 million to EUR 10 million. ERDF funding led to the new construction or improvement of 99,145 km of road and 3,714 km of new or improved railway lines. However, socio-economic impacts of these projects could not be assessed due to lack of comparable data. However, Steer Davies Gleave (2010) also highlight the importance of proper CBA to obtain the best value for (EU) money, taking the example of conventional rail upgrades that are less costly than new high-speed rail lines but which also brought about time savings in the rail network of Poland and Czech Republic of 10% and 20%, respectively.

The European Investment Bank (EIB) is regularly undertaking ex-post evaluations of their co-funded projects that are contracted to external experts. In 2003 the bank asked for an ex-post evaluation of 10 projects in Central and Eastern European countries. 7 out of the 10 projects were evaluated "good" or "satisfactory", only one was "poor" and the other two unsatisfactory. Properly forecasting transport demand was difficult for the projects due to the economic restructuring in these countries during the 1990`s. In three projects EIB projections were less than 50% of the actual, i.e. strongly underestimating demand and thus potential benefits, in two cases the EIB overestimated demand by more than 50%. The auditors also identified that project success was rather measured in terms of km of constructed concrete and not against the (economic) objectives: "*Project objectives, as presented in project appraisal and approval documents, were defined in terms of physical assets, e.g. km of road rehabilitated, without explicitly stating the desired project outcomes which were the basis of the economic analysis*". This was also reflected in the contract conditions that "*tended to focus on procedures and financial conditionalities, rather than risk mitigation and the achievement of project objectives*" (EIB 2003, p.2). This reflects that the EIB in their early funding decisions also focussed on administrative control rather than on economic performance proven by sound assessment of cost and benefit, so a similar concept as observed by the first two major reports of the ECA concerning DG MOVE and DG REGIO.

4.7. Monitoring and transparency

Administrative control at the European Commission has been improved by the set-up of the TEN-T EA. The Agency tracks the status of implementation of projects and the level of funding spent, as well as the comparison with planned progress and spending. On this basis regular reviews of TEN-T implementation are published (European Commission 2010b). This is an important element of monitoring and transparency.

However, the second aspect concerns monitoring the fulfilment of the objectives that were guiding the funding decisions, in particular the estimates of socio-economic benefits and costs. In cases where public money is involved, the European Commission (whether DG MOVE, DG REGIO or TEN-T EA) must operate a database of the economic and transport studies underlying a financing and investment decision. This mitigates the criticism of the European Court of Auditors that for instance in some DG REGIO funded projects not even

minimal technical assessments are to be found in the EC files (ECA 2010) and also would pave the way for enabling other monitoring exercises including:

- To monitor the successive development and improvement of a project specification and assessment, given that large projects often experience revisions of their specifications and reveal a planning history leading to continuously improved and mature projects.
- To enable ex-post analysis, since the relevant studies can be made available to auditors and the interested public without having to depend on the archives of authorities or project promoters.
- Depending on the nature of funding and the specific requirements for confidentiality (see section 4.5) allowing to publish all assessment studies or summaries thereof on a website generating transparency, which in turn is important for acceptance of projects.

Such a database of studies (ex-ante cost-benefit / economic studies, transport impact studies, financial studies, environmental studies as well as detailed ex-post studies on single projects) and the public web-access could be integrated in the TENtec information system, which so far only seems to collect financial data and data related to implementation progress.

5. RECOMMENDATIONS FOR ASSESSMENT, PROCUREMENT AND ELIGIBILITY FOR FUNDING

KEY FINDINGS

- Transport planning is to be based on three pillars: **Strategic goal setting, systems analysis and optimal network design as well as project analysis and assessment**. In past practice, the assessment work was predominantly oriented to project assessment, while the compliance with strategic goals and the integration of projects into an optimal network configuration was neglected. The rapporteurs to the European Parliament⁹ and the European Commission's IASG¹⁰ will make first attempts towards an integration of all three pillars in transport network planning.
- Assessment methodology has to be adjusted and extended to the issues of project and network evaluation. At present no **European transport model** exists for generating reliable figures which could be applied for the determination of the best network configuration. Assessment which is only based on partial CBA neglects important network effects and fails to quantify the European added value. Therefore further methodological progress is necessary.
- **Environmental Impact Assessment (EIA)** is carried out for all projects but at different levels of detail. Definition of standards for the different phases of planning (pre-feasibility, feasibility, final project plan) is necessary. In this context a clear indication of intolerable risk and environmental infeasibility is helpful to reduce planning costs and avoid cost overruns in the phase of implementation.
- **Strategic Environmental Assessment (SEA)** should start in the phase of systems analysis and optimal network design to identify environmental bottlenecks as soon as possible. It ends by checking the investment programme for environmental feasibility. For large projects it can be performed on a corridor level.
- **Climate Impact Analysis (CIA)** is important to measure the contribution of network configurations and projects to the EU climate goals. It consists of the measurement of changed GHG emissions from traffic, infrastructure operation, maintenance and management, infrastructure construction and indirect effects on the carbon footprint of other sectors.
- The planning and procurement processes often suffer from **different standards in organisations and political preferences** which are not always consistent with the best functioning of the supra-national networks. Furthermore, biases between EU objectives and planning reality can occur through **moral hazardous behaviour** of Member States to increase the chance of high EU co-funding.

⁹ Koumoutsakos and Ertug (2012)

¹⁰ IASG (2011)

- The eligibility conditions, in particular the **conditionality criteria**, may have been interpreted in different ways in the past. It will be necessary to give more narrow and clear definitions for eligibility and the quality of documents (as e.g. the strategic plan and the assessment of projects). A non-negligible problem seems also to prevail with **enforcement of the existing conditionality criteria**, which thus needs to be improved.
- **Funding rules should be harmonised.** The European Commission has developed a proposal for setting up a Common Strategic Framework (CSF) for funding, including ERDF and CF but not TEN-T funding. This is certainly a step in the right direction for making the funding options and the control of funds allocation more transparent.
- Better coordination and information is a pre-condition for a learning process taking into account the good and bad practice experience of the past. The establishment of a **central data office** is recommended (e.g. within the TENtec information system operated by TEN-T EA) containing the project dossiers (fiches) with links to all underlying documents and the monitoring of results after project completion, including ex-post analysis on the project and corridor scale. **TEN-T projects are multi-national** by nature, therefore the **central data office should be at the European Commission.**
- **Better participation of stakeholders is indispensable** because of growing resistance to large transport investment projects. Participation is a current process which must begin long before deciding about a project and should not stop after the formal approval of a project. Public access to the data office should be an asset, at least enabling access to meaningful summaries of the assessments.

5.1. Improvements for Assessment Methodology

5.1.1. Integration of long-term strategic goals

The expert group 1 for preparing the concept of TEN-T 2011 has clearly stated that – in addition to the usual components of CBA, which are dominated by the time and operation costs of users – also long-term strategic goals have to be considered. Strategic goals are the long-term regional cohesion and development as well as the reduction of the greenhouse gas footprint. The impact of large projects on regional cohesion and development is highly uncertain and therefore either neglected in economic appraisal or overestimated when seeking regional funding. Therefore a sound regional impact analysis is necessary to deliver reliable inputs for the estimation of the contribution of large projects to regional strategic goals. Another category of long-term strategy is the carbon footprint. Beyond all estimations of economic values of GHG reduction the project appraisal has to consider to what extent a large project contributes to long-term strategic reduction goals, e.g. the target set in the White Paper of the European Commission (2011a) to reduce the carbon footprint of the transport sector by 60% by the year 2050.

5.1.2. Systemic analysis for the choice of best network design and project alternatives

(a) Development of a sound multi-modal European transport model

The transport model TRANS-TOOLS which has been developed for the European Commission and is currently applied by the Joint Research Centre in Seville has – even after some years of development – not reached the level of performance for generating

well-tested transport data for corridors and projects. Therefore it is necessary to improve the European modelling base so that it can serve to generate reliable framework data which can be used for European corridor analysis or for the more detailed national transport modelling. This is important insofar as an international comparison of assessment results is only meaningful if comparable standards for generating the transport figures are applied. The major benefits evaluated in CBA stem from the saving of costs of time use, operation, accidents and external diseconomies which can be directly derived from the transport data forecast (comparing the situation with and without the project).

(b) Use of more sophisticated methods for the evaluation of economic impacts

The CBA guidelines of DG Regio (European Commission 2008) provide a sound general concept for a standardised evaluation of projects. However, when evaluating large projects on a network scale, the partial approaches of CBA and MCA are not sufficient to capture all social costs and benefits. In the literature a number of suggestions have been developed to overcome the weaknesses of a too narrow CBA (Proost et al. (2010); Priemus et al. (2008); Rothengatter (2008); Schade (2005); IHS (2012); OMEGA (2012) which can be used as a baseline for elaborating a comprehensive method to evaluate primary and secondary effects of large investments. The larger the project the higher is the contribution of secondary effects to the costs/benefits to be expected.

(c) Interdependency analysis

Conventional CBA and MCA starts from the hypothesis that projects are independent from each other and their impact can be measured by a "with/without" approach. However, the interdependency of network components (links, nodes) is an intrinsic feature of transportation networks. There exist manifold network interdependencies, complementary and substitutional relationships between TEN-T projects (Szimba, 2008) as well as between TEN-T projects and national/regional network improvements, e.g. between HSR and regionally synchronised rail passenger transport. As the national proposals for TEN-T investments often do not take into account network synergies in border areas, supplementary analyses are necessary to measure the full European added value by a large transport project.

(d) Explicit integration of dynamic feedbacks

As has been discussed in section 2.5, dynamic models like CGEurope plus SASI or ASTRA have been developed on the European level, which are able to capture essential feedback effects between the transport sector, the economy and the environment in a dynamic context. Such types of models give in particular additional decision support if the time trajectory for building up a desired configuration of a network is the focus.

(e) Explicit consideration of uncertainties

High risk or even uncertainty about future benefits or cost is an intrinsic element of planning for large projects. The prominent studies quoted in (b) include chapters dedicated to this problem and suggestions for treating structural, planning, operative, financial and political risks.

5.1.3. Improved standards for EIA, SEA and CIA

The assessment of projects should include an EIA (Directive 2011/92/EU) according to standards which are adjusted to the stage of planning (pre-feasibility, feasibility, final plan). The transport investment programme or the corridor impacted by a large transport project should be subject to an SEA in standardised format. SEA can be organised as a process starting with optimal network design and ending with the evaluation of the final investment programme. CIA is at present performed only partly, i.e. for the traffic

activities. But it should also include the infrastructure provision, as well as the operation/maintenance, and the impacts on the carbon footprint of other sectors. The latter effects are usually neglected in assessment studies.

Conclusion: A further development of the scope and the instruments of network and project assessment is necessary to capture the full range of social costs and benefits of large transport projects.

5.2. Recommendations for the planning and procurement process

5.2.1. Planning and procurement

Flybjerg et al. (2003) in particular identify the process of planning and procurement as a main cause of failure. The EVA TREN project (2008) analyses the project histories of selected TEN-T projects and concludes with similar findings, focusing on the missing incentives of planners to adapt to changes through a controlled adjustment process. In particular the public players in the project games try to stick to old agreements and figures as long as possible, which makes an adaptation to new situations difficult and costly. Priemus (2007), OMEGA (2012) or Chevroulet et al. (2012) give recommendations for a change of the planning and procurement processes to improve on the adaptivity of the procurement process. These are considered in the recommended planning and procurement scheme presented by **Error! Reference source not found..**

5.2.2. Need for coherence between planning and financing

A number of examples – EU and international – show that as soon as the financial responsibility is not coherent with the planning responsibility, a risk of planning failure occurs which finally has to be covered by the financing organisation. A good example for the phenomenon is the “Big Dig” project in Boston which links two major interstate highways underground in the central area. Costs have almost quadrupled and many planning problems emerged during the construction phase. The project has been planned and managed by the Boston-based Massachusetts Governor’s Office to the Massachusetts Turnpike Authority (MTA) while it was financed by the Federal State. As the construction was started even before the project plans were mature massive problems cropped up during the construction phase and after. The latter could also be observed for our case study on the West Coast Main Line plans of 1996.

Conclusion: The transparency of the planning process has to be fostered and truth-telling of the involved agents supported. While complex large projects need a comprehensive planning of all components it is recommendable to preserve enough flexibility to adjust to changes during the long planning and procurement process.

5.3. Recommendations for stricter control and monitoring by the European Commission

5.3.1. Eligibility and conditionality

Depending on the eligibility conditions a country can enjoy up to 85% of EU co-funding. In the past the rules of ex-ante conditionality (see section 3.2) have not been applied very strictly. There was also some incentive that the Member States formally fulfilled the ex-ante conditionalities and applied CBA essentially correctly, but their plans were based on the

most optimistic assumptions with respect to the traffic forecast and impact assessment ("optimism bias"). Private consultancies hired by the Member States for forecasting and impact modelling had little incentive to disappoint their clients.

Such moral hazard problems could lead to over-design and over-investment into transportation projects. Cohesion countries and some of the accession countries give good examples for the hypothesis that a stricter control and monitoring of EU co-funding would lead to higher efficiency in investment and encourage the Member States to balance their investments in a way that more private investments can be attracted by the investments into common goods of the states and the EU. If stimulation of private activities which make use of such transport infrastructure investments is not successful, then all calculations of benefits stemming from time and operation cost savings are paperwork and the project does not actually foster economic development. Therefore it is necessary to supplement the principle of subsidiarity by stricter control and monitoring of the European Commission, in particular if the funding rates are high.

5.3.2. Harmonisation of funding regulations

There are a large number of different EU funds for different sectors and issues which lead to the lack of transparency, uncertainty of applicants, administrative problems with the European Commission and some risk of fund-seeking strategies. The European Commission has worked out a proposal for the regulation laying down common provisions for funds (COM(2012)496 final). It includes ERDF and CF, the most important sources of transportation project funding, but not TEN-T. Nevertheless it would bring progress into funding allocation and control if this regulation was decided and put in place.

Conclusion: As soon as major EU funding is considered the principle of subsidiarity has to be complemented by a strict control and monitoring of projects by the European Commission. The conditionality criteria for ERDF and CF funding should be set and enforced more strictly to avoid moral hazard, in particular if high funding rates are considered.

5.4. Recommendations for constructing a knowledge base for project success

The basic recommendation is to create a better platform for learning from previous experiences (ex-post analyses and data exchange), to apply a permanent risk management, and to apply system-based evaluation techniques. In this context ex-post evaluation is a most important instrument. This instrument has been applied by EIB (results not published on a project scale) and for some aggregate studies for the European Commission (Deloitte 2007, Steer Davies Gleave 2010). Valuable information has been published by project operators (e.g.: Oeresund Konsortiet; SNCF).

It is therefore recommended that an observatory for all large investment projects be established, which are co-financed by the European Commission, possibly as an office within TEN-T EA. This data office could be integrated into the TENtec system operated by the European Commission TEN-T EA.¹¹ Concerning the TENtec system we would add two further recommendations: (i) The reporting of monetary values (e.g. investment cost, funding contributions) should clearly indicate the price base and, if applicable, applied exchange rates for converting into Euro. (ii) Though we did not get access to the evaluation figures (e.g. CBA ratio, IRR) the Members of the European Parliament should have access

¹¹ <http://ec.europa.eu/transport/themes/infrastructure/tentec/>.

to such key figures in the TENtec system to enable parliamentary control of co-funding decisions on large projects.

Conclusion: A data office can be established, possibly within TEN-TEA, to store all relevant project information including national sources on a project file with links to sources which are held with other organisations.

5.5. Recommendations for stakeholder participation

All studies mentioned in section 5.2 also stress the importance of a continuous stakeholder participation. In particular, the RAMP study of OMEGA (2010) makes the point that it is necessary to secure an effective involvement of all project stakeholders in a project, not only its supporters or sponsors. Good practice examples from large projects, as for instance the Oeresund fixed link, the planning of the West Coast Main Line in 2003 or the ongoing planning of the Fehmarn Belt Fixed Link, show that an early consideration of environmental bottlenecks may lead to adaptations in project design, which limits environmental risk and at the same time avoids a massive cost increase due to necessary adaptations at late project stages as well as ensuring acceptance by the population.

An outstanding example on the negative side is the Stuttgart 21 (S21) project (part of the priority corridor PP17). A prime lesson which can be learned from this prominent example is that participation of stakeholder groups should be organised as a permanent process and not stop after the legal approval of a project. The protest movement of S21 was led and supported by serious and well-informed parties, who could have contributed their knowledge in a positive way in an earlier phase of the project, while after construction had started they could only protest and join the violent groups of opponents, providing them with rational arguments. A second lesson is that an early communication with stakeholders would have made the weak points of the project more transparent (the major bulk of cost is not caused by the station, but rather the underground connections to the regional network) so that a re-design could have been considered and supported by a mediation process. But unfortunately, governments and Deutsche Bahn AG promoted the project in the design of 1994 as being "*without any reasonable alternative*" which naturally posed a challenge for the opponents to show that alternatives did indeed exist. Therefore, the third lesson is to start the planning process with a more open discussion of alternatives included in the pre-feasibility study (see **Error! Reference source not found.**) and follow it by a discussion of variants of the best alternative found for including in the feasibility study (see **Error! Reference source not found.**) and organise a mediation process in the course of legal preparation.

Conclusion: Participation of stakeholder groups should be organised as a continuous process which does not stop after approval of a project. Alternatives should be discussed within a mediation process. Components of a large complex project could be planned flexibly so that compromise solutions can be found.

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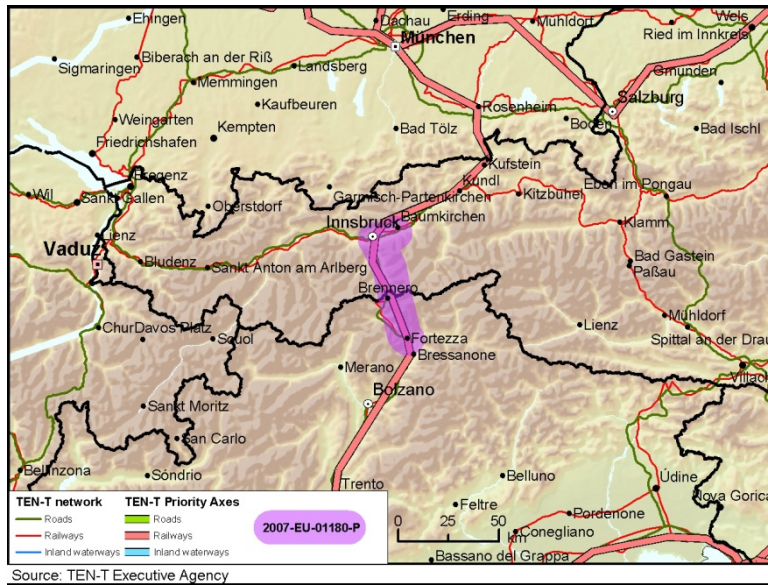
ANNEX 1: BRENNER BASE TUNNEL (BBT)

Table C1-1: Project summary of Brenner Base Tunnel (BBT)

Aspect	Description	Aspect	Description
Project Title	Brenner Base Tunnel	TEN-T code	2007-EU-01180-P
Countries / area	Austria, Italy	Start date	April 2011
Mode(s)	Rail	End date	December 2013 (present phase) ; 2022 (total project)
Managing authority	Brenner Basistunnel BBT SE - Galleria di Base del Brennero	Duration	
		Delay (mth)	
Investment cost (m€)	2,195 (2007-2013) 7,460 as of 1 January 2010 (total project with tunnel and access links) 8,062 including a total risk reserve of 1,144	Length (km)	64
EC funding TEN-T (m€)	592.65 (2007-2013)	EC share	27%
EC funding Cohes. (m€)	d.n.a.	EC share	d.n.a.
Funding agent 1	National budget – Austria	Value (m€)	801.2 (2007-2013)
Funding agent 2	National budget - Italy	Value (m€)	801.2 (2007-2013)
Cost-benefit-analysis	Ernst & Young Financial Business Advisors S.p.A: Brenner Basis Tunnel Project Cost Benefit Analysis, July 2007.	CBA ratio	Social discount rates :0%;2.5%;8% EBC ratio: 4.2; 1.9; 0.5 ENPV: bn€11.147; bn€2.435; bn€1.000 EIRR: 4.7%
		Public y/n	Y
Transport scenario	Traffic forecast by ProgTrans	Dated from	2007
Externalities covered	Environmental damage costs produced by air pollution, climate change, electromagnetic fields, road accident costs, noise costs, congestion costs	External cost savings (m€)	2030: 97.5 2050: 190.3
EIA	TAE Consulting/ILF: Non-technical summary of the environmental impact assessment, 10.6.2003 - Noise, vibration, air and public health - Geology, surface water and groundwater - Landscape - Ecosystems, vegetation, agriculture and fauna.	Public y/n	Y
CIA	None	Public y/n	
Financial analysis	Not available	Expected RoI	Not available
Ex-post evaluation	d.n.a.	Cost overrun (m€)	d.n.a.

Source: own analysis

Figure C1-1: Location of the Brenner Base Tunnel Project



Source: TEN-T Executive Agency

“The Brenner Base Tunnel is the centrepiece of Priority Project 1, railway axis Berlin-Verona/Milano-Bologna-Napoli-Messina-Palermo. This project foresees the construction of two low-gradient parallel tunnels envisaged mainly for the transport of heavy goods across the Alps. It will run for 55 km from Innsbruck (in Austria) to Franzensfeste/ Fortezza (in Italy). Adding the existing Innsbruck railway bypass the entire tunnel through the Alps will be 64 km long, the longest underground rail link in the

world. The cross-border tunnel across the Alps will remove a major bottleneck in an environmentally sensitive area, shifting heavy traffic from road to a high-quality rail service.”¹²

1.1. Methodology and remarks on CBA and project selection

A first Cost-Benefit Analysis of the Brenner Base Tunnel project was conducted in 2004 by external consultants Ernst & Young (report not available), followed by an update in 2007 (report publicly available), taking on board new traffic forecast by ProgTrans (also publicly available). The methodology of the CBA followed the guidelines set up by the European Commission and, specifically for railway projects, by the European Investment Bank (RAILPAG). The CBA covered 68 years containing the planning and construction period as well as the concession period (2021-2070).¹³ The procedure quantifies the increase of general welfare in terms of “social surplus”, defined as the sum of

- “consumer surplus”,
- “producer surplus” and
- savings of external costs.

As external costs were included in the CBA:

- Environmental costs (e.g. damage produced by air pollution, climate change, electromagnetic fields, etc);
- Road accident costs;
- Noise costs;
- Traffic congestion costs^{14.15}

¹² Trans-European Transport Network Executive Agency. Online : http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/multi_country/2007-eu-01180-p.htm (21.11.2012).

¹³ Ernst&Young (2007): Brenner Base Tunnel Project, Cost-Benefit Analysis, p. 3.

¹⁴ Congestion costs are often mistaken as external costs which they are not in a strict sense.

¹⁵ Ibidem

The CBA resulted in an economic internal rate of return of the project of 4.73%, with a total financial investment cost of EUR 6 billion, converted to an economic investment cost of EUR 3.44 billion; in a sensitivity test, assuming 25% higher construction costs, the EIRR is dropping to 3.91%.

While the methodology used for the CBA can be qualified as state-of-the-art, the analysis has been conducted prior to the financial and economic crisis and hence with a brighter economic outlook than that of today.

The project was not selected on the basis of a CBA ranking in either of the two countries. Its importance for the strengthening of the Berlin-Verona transport axis justified the inclusion into TEN-T priority project n°1.

1.2 Methodology and remarks on environmental analysis

In the framework of the BBT Project various EIAs were carried out. The following elements have been investigated in the environmental impact analysis:

- noise, vibration, air and public health
- geology, surface water and groundwater with an open design and in the construction areas
- landscape
- ecosystems, vegetation, agriculture and fauna.¹⁶

The methods which have been used by conducting the EIAs were all in line with the existing EU legislation.

1.3 Characteristics of the transport demand scenario and its economic drivers

In 2005 the Swiss transport consultancy ProgTrans AG developed and updated the traffic forecast concerning the Brenner axis. In 2007 an update followed and contained a traffic forecast which was developed with a multimodal transport network model covering the transalpine traffic-related origin-destination relationships of all European Union countries plus Switzerland and Norway. Six traffic forecast scenarios were defined for freight transport:

¹⁶ BBT SE (2003): Non-technical Summary of the Environmental Impact Assessment of the Project (june 2003) 42.

Table C1-2: Brenner traffic forecast 2004-2030 under six scenarios (million tonnes)

Brenner Traffic Forecast (in million tonnes)												
Year	BasisTrend		Trend		Minimum		Distortion		Worstcase		Consensus	
	Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail	Road	Rail
2004	31.5	10.7	31.5	10.7	31.5	10.7	31.5	10.7	31.5	10.7	31.5	10.7
2015	43.9	14.9	38.8	14.9	38.9	14.9	38.8	19.8	38.9	19.8	31.9	14.9
2020	47.3	20.8	41.8	21.6	41.8	16.6	41.8	27.6	41.7	22.0	31.8	22.6
2025	50.6	28.1	44.7	30.2	44.9	18.4	44.5	37.6	44.7	24.5	30.9	32.3
2030	54.2	31.8	47.8	33.2	47.2	19.5	45.8	49.1	48.0	27.0	30.9	36.2

Source: ProgTrans (2007): Brenner Basis Tunnel. Aktualisierung Verkehrsprognose. Schlussbericht, p. 197

The basis of the traffic forecast covered socio-economic and policy drivers at an appropriate and geographical level:

- Population (inhabitants, age structure, driving licence ownership)
- Economy (GDP, domestic demand, foreign trade (exports, imports), private consumption)
- Transport policy (market regulation, prices and taxes, infrastructure and supply-side policy)
- Logistics (shippers' requirements, organisation)
- Mobility behaviour

The second step performed for the update and expansion of traffic forecasts for the Brenner Base Tunnel was the estimation of transport demand in the form of origin-destination matrices at NUTS 3 level (Alpine region), NUTS 2 level (Austria, Italy, Germany, France and Switzerland) and for the rest of Europe at NUTS 0 level. This is based on current and expected socio-economic developments of national economies and of individual sectors (see above). The predicted demand matrices were assigned the forecast road and rail networks.

A so far unpublished update of the traffic forecast on the Brenner axis was also prepared in October 2012, taking account of the most recent, crisis-reflecting long-term socio-economic forecasts.

1.4. Investment cost and structure of financing

The European Joint-Stock Company "Brenner Basistunnel BBT SE" was founded on December 16th 2004 with a shareholders agreement between Austria, Tyrol and RFI (Rete Ferroviaria Italiana) as the successor company of the EEIG Brenner Base Tunnel. The main task for the BBT SE lies in the planning and construction of the tunnel and the development of the financing model as well as the grant details of the operational license. The State Treaty signed in Salzburg on the 30th of April 2004 laid down the legal framework. Originally, 50% of the company shares were owned by RFI and 25% respectively by the Austrian Republic and the land Tyrol. In April 2011 the share distribution was as follows: Austria: 50% ÖBB Infrastruktur; Italy 50% TFB (of which RFI: 84.98%, Autonomous Province of Bolzano; 6.22% Autonomous Province of Trento: 6.22% and Province of Verona 2.58%).¹⁷

¹⁷ Bergmeister (2011): Brenner Basistunnel, p. 174.

Due to the fact that the financial engineering has not yet been finalised we will have a closer look at recent cost updates. The most recent one of 2010 put total financial investment costs of the global Brenner Base Tunnel project to EUR 7.46 billion (in prices of 1 January 2010) with the following break down:

- Basic structure 65%
- Outfitting and Equipment 15%
- Management and land acquisition 12.5%
- Provision for risks 7.5%

Including a total risk allocation of EUR 1.144 billion, total investment costs were tabled at EUR 8.062 billion. This risk allocation reflects the specific requirements of the Austrian ÖGG directive.¹⁸

The basic structure of financing of this large-scale project is quite simple: By following the ÖBB internal manual and ÖGG directives and the European legislation the European Commission formally guaranteed a very high level of support for TEN-T priority project n°1, with a grant of up to 20% of works. Austria and Italy will equally share the remaining costs. However, Austria and Italy hope that the EU will shoulder one third of the entire costs for the construction of the Brenner Base Tunnel.¹⁹

Concerning the financial return on investment for the entire Brenner Base Tunnel project we cannot be very precise because this does not appear in the documents available for our analysis. However, as the funding is entirely public, the economic internal rate of return is the more appropriate indicator for the viability of the project.

1.5 Cost developments over the life-cycle of the project

During the implementation phase the following finance planning has been based on the report of the European Coordinator Pat Cox, in charge of the Brenner project.

The financial framework for the period of 2007-2013 the TEN-T budget focused on the cross-border sections and bottlenecks of the priority project no.1. In total EUR 960 million have been committed to the project, of which EUR 786 million for the Brenner Base Tunnel. The financial commitment was always based on decisions made by the European Commission in 2008.

In the context of Priority Project No. 1 five decisions were made by the European Commission of which two concerned the Brenner case. The decisions covered the studies and the works on the tunnel and the covering finances. The European Commission supported the studies with EUR 193 million (for the period 2010-2013) with a co-financing rate of 50% and with an amount of EUR 593 million, it supported the works in the actual tunnel with a co-financing rate of 27%.²⁰

These finances were confirmed once again in the most recent European Coordinators' report of 2011. The studies on the Brenner Base Tunnel served to assess the risks, costs and duration of the construction of the tunnel. The EU contribution remains at

¹⁸ Österreichische Gesellschaft für Geomechanik (ÖGG): Richtlinie Kostenermittlung für Projekte der Verkehrsinfrastruktur unter Berücksichtigung relevanter Projektrisiken.

¹⁹ Bergmeister (2011): Brenner Base Tunnel, 110-111.

²⁰ Pat Cox (2010): TEN-T Trans-European Transport Networks. Annual Activity Report 2009-2010 for PP1. Railway axis Berlin-Verona/Milano-Bologna-Napoli-Messina-Palermo, Brussels.

EUR 193 million. Concerning the works on the Brenner Base Tunnel the amount of EUR 593 million is still valid in view of the State Treaty between Austria and Italy covering the remaining costs.

1.6. Conclusions

The financial investment costs for the Brenner project were occasionally reviewed and adjusted. The two most recent and major revisions took place in 2006 and 2010.

Traffic forecasts were carried out and revised occasionally. The latest one was carried out in autumn 2012 but has not yet been released.

A CBA was performed in 2004 and updated in 2007, before the financial and economic crisis.

Environmental studies followed EU regulations.

All in all, assessment studies are in line with European legislation; a separate Climate Impact Assessment is not legally required and has not been undertaken so far.

Appendix 1: Chronology

1971: The idea of a tunnel at the Brenner was revived. The International Union of Railways (UIC) commissioned a study for a new Brenner railway line with a base tunnel. By 1989 three feasibility studies had been drawn up which formed the basis for further planning of the Brenner Base Tunnel.

1994: The European Union included the Berlin-Naples corridor in the list of 14 priority projects. The European Council declared during a meeting in Essen that the Brenner Axis becomes project n° 1 on the list of TEN-T Priority Projects. The Priority Project Brenner Base Tunnel is hence one of the most important projects the European Council adopted in the context of the Trans-European Transport Networks.

1999: The BBT EWIV (Brenner Basistunnel Europäische Wirtschaftliche Interessenvereinigung – European Economic Interest Grouping EEIG) with Brenner Eisenbahn GmbH (BEG), working in Austria, and the Italian railway company Ferrovie dello Stato was founded with the goal of developing the preliminary project (geological survey and definition of the route).²¹

2001: White Book of the European Commission: TEN-Projects, with 14 priority projects, including the Brenner Base Tunnel. The European Commission formally guaranteed a very high level of support for priority project 1, assigning it 20% of the budget.

2003: Common declaration of the Austrian and Italian Ministers for Infrastructure and Transportation.

2004: Austria and Italy signed a State Treaty to build the Brenner Base Tunnel. In that same year, what is today the BBT SE, was established. Decision No. 884/2004/EG of the European Parliament and of the Council to modify Decision No. 1692/96/EG: the build-up of a trans-European transportation network priority Projects to be begun before 2010; TEN –

²¹ Konrad Bergmeister (2011): Brenner Basistunnel, 49-50.

Axis No.1: Berlin-Verona/Milan-Bologna-Naples-Messina-Palermo with the Brenner Base Tunnel.

2005: the phase for beginning of exploratory tunnel programme began.

2007: Establishment of the Brenner Corridor Platform under the coordination of Karel Van Miert with BBT SE and including the appropriate Ministries of Germany, Austria, Italy, the regions of Bavaria, Tyrol, the provinces of Bolzano, Trentino and Verona and the three railway companies DB, ÖBB with BEG and RFI

2008: Completion of the final project and of the project documentation for the declaration of environmental compatibility and submission of same in Austria and Italy.

2009: Financial Approval for the infrastructure program including the Brenner Base Tunnel by the Austrian Parliament and Bundesrat.

2010: The Inter-Ministerial Committee for Economic Planning (CIPE) approves financing for the Brenner Base Tunnel in Italy.

2011: the EU approved, up to 2013, TEN-T funds amounting to EUR 592.65 million, i.e. 27%. The hope is that the EU will shoulder one third of the entire costs for the construction of the Brenner Base Tunnel and that Austria and Italy will equally share half of the rest.²²

²² <http://www.bbt-se.com/en/project/history/> (09.11.2012).

Appendix 2: Selected Bibliography

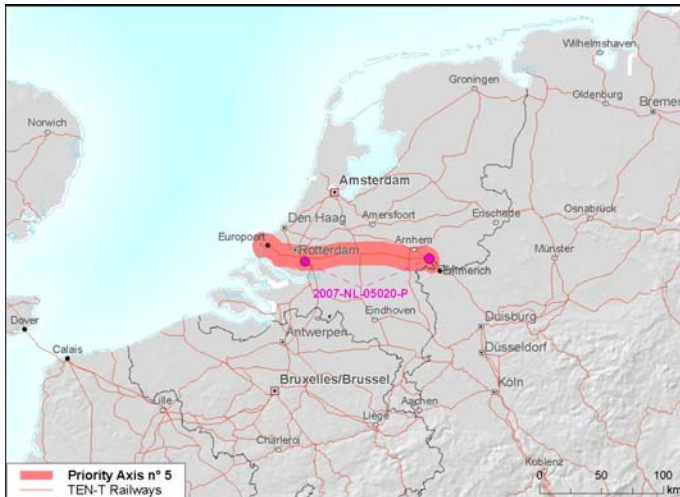
Year	Type	Title
2012	Traffic	ProgTrans AG (2012): Betriebs- und volkswirtschaftliche Analyse der Betriebsphase des Brenner Basistunnels, Wirtschaftsforschungsinstitut Handels-, Industrie-, Handwerks- und Landwirtschaftskammer Bozen Abschlussdokumentation 24. Oktober 2012. (not published)
2012	General	http://www.bbt-se.com/en/project/history/ (08.11.2012)
2012	General/Financial	Trans-European Transport Network Executive Agency. Online : http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/multi_country/2007-eu-01180-p.htm (21.11.2012)
2011	General	Konrad Bergmeister: Brenner Base Tunnel: Project Status, in: Tunnel 2/2011, pp. 18-30
2011	General	Konrad Bergmeister (2011) : Brenner Base Tunnel, BBT SE, Innsbruck/Bozen.
2010	General	Brenner Base Tunnel: Stage reached by Construction: http://www.tunnel-Online.info/en/artikel/tunnel_tunnel_1_10_Brenner_Base_Tunnel_Stage_reached_by_Construction_827869.html (06.12.2012).
2007	CBA	Ernst & Young: Brenner Basis Tunnel BBT SE. Brenner Basis Tunnel Project Cost Benefit Analysis, July 2007.
2007	Traffic	Aktualisierung der Personen- und Güterverkehrsprognose für den Brenner 2015 und 2025 (2007).
2005	General	Österreichische Gesellschaft für Geomechanik (ÖGG): Richtlinie Kostenermittlung für Projekte der Verkehrsinfrastruktur unter Berücksichtigung relevanter Projektrisiken
2003	Environment	Brenner Base Tunnel SE: Non-technical Summary of the Environmental Impact Assessment of the Project, June 2003.

ANNEX 2: BETUWE LINE FOR RAIL FREIGHT

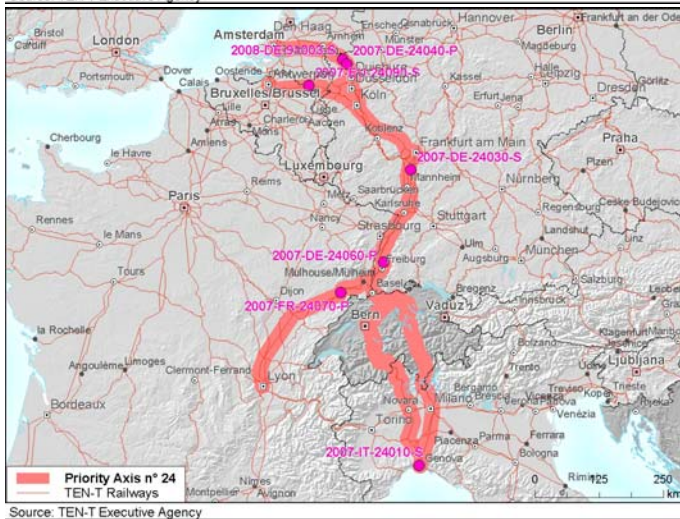
Table C2-7: Project summary BETUWE Line for rail freight

Aspect	Description	Aspect	Description
Project Title	Dedicated rail freight line to link Port of Rotterdam with the Dutch-German border	TEN-T code	PP 5 TENtec: 0500
Countries / area	The Netherlands (NL) plus cross-border section to Germany (NL-DE)	Start date	1998 (1997)
Mode(s)	Rail	End date	2008 (2007)
Managing authority	ProRail B.V. (The Netherlands) DB Projektbau GmbH (Germany)	Duration	10 years
		Delay (mth)	24-36
Investment cost (m€)	4 705	Length (km)	160 km
EC funding TEN-T (m€)	197	EC share	~ 4.2%
Funding 1	NL state budget	Value (m€)	4 404
Funding 2	NL regional budget	Value (m€)	8
Funding 3	Other sources	Value (m€)	97
Cost-benefit-analysis	Missing Simplified estimations of payback period	CBA ratio	
		Public y/n	Y
Transport scenario	Dutch rail operator	Dated from	1991
Externality covered	Missing	Ext. cost (m€)	
EIA	Air pollution (further aspects influenced route design)	Public y/n	(Y)
CIA	Missing	Public y/n	
Financial analysis	Knight Wendling 1992 CPB 1993	Payback	10-20 yr
		FIRR	
Ex-post evaluation	Under preparation	Cost overrun (m€)	984 (27%)

Source: budget figures from TENtec Information System 2012, m€ = million Euro, own analysis



Source: TEN-T Executive Agency



Source: TEN-T Executive Agency

The BETUWE line is a newly constructed railway line dedicated to rail freight, only. It connects the Dutch Port of Rotterdam with the Dutch-German border by a new 160 km long double track rail line.

The border crossing is located between Zevenaar (Netherlands) and Emmerich (Germany). A full exploitation of the potential to carry rail freight requires that the connections on the German side from Emmerich to Oberhausen are developed as well.

The BETUWE line itself being Priority Project 5 (PP5) of the TEN-T as defined in 2004, constitutes also an element of the larger Priority Project 24 (PP24) running from Rotterdam to Genua (Genua-Basel-Duisburg-Rotterdam) with branches from/to Lyon and Antwerp. Further the line is an element of European rail freight corridor A Rotterdam-Genua to be equipped with the European Rail Traffic Management System (ERTMS).

The initial impulse to build the Betuwe line seemed to come from a master plan for the future of the Port of Rotterdam in 1985, which instead of closing down the existing parts of the line suggested to renew/build it as a dedicated rail freight line (see e.g. Pestmann 2001, Vrijland 2004). In 1990 the Dutch government recognized the strategic importance of a modernization of the Betuwe line. The cost estimate for its construction was EUR 1.5 billion, expecting a demand of 50 million tons for the year 2010. After an initial approval of the project by government the project development was stopped by a change of the governing parties. However, the so-called Hermans Commission recommended to continue the project (Hermans et al. 1995), so that in 1995 the new government took the decision to implement the project at a cost of EUR 3.67 billion, of which 20% should be sourced from private investors. In 1996 the track plan was fixed and construction of the new sections of the Betuwe line started in 1998. Nevertheless, in 2000 the Netherlands Court of Audit stated "that a sound and comprehensive cost/benefit analysis of the Betuwe Route is missing." (quoted after Vrijland 2004, p.4). At least since the beginning of construction there has been intense debate in the public in The Netherlands about the usefulness and the cost of the Betuwe line. The whole process was debated in parliament based on a 455 pages report describing in accurate detail how the decision on the Betuwe line was actually taken (TCI 2004).

In 2007 the Betuwe line was completed and started operations. Five tunnels with a length of 18 km had finally been built, 190 animal passages, 130 bridges and 95 km of the 160 km track were implemented in parallel to the A15 motorway to mitigate environmental and health impacts. The Betuwe Line is designed for a capacity of 10 trains per hour per direction. Between 2008 and 2011 KeyRail, the operator of the Betuwe line, reports about a

quadrupling of demand reaching a level of 500 trains per week in 2011 and having a long-term target to run 900 trains per week (Keyrail 2011).

Following the completion of the core infrastructure of the Betuwe line in 2007, further EU funding was provided in the following years to both The Netherlands and Germany e.g. to extend the line to Maasvlakte West, to retrofit locomotives with ERTMS, to install ERTMS or to plan for a third track in the border crossing sections. Thus, the total cost of the project has further increased.

Despite the joint Dutch-German agreement about the construction of the Betuwe Line in 1992 (Agreement from Warnemünde) the progress on the German side for the 72 km of track connecting Emmerich at the border with Oberhausen has been rather limited. In 2002 the Federal State and the State of North-Rhine Westfalia reached an agreement that the Federal State would pay for 64% of the infrastructure cost (at that time estimated to be EUR 895 million). The project has been divided into 12 sections, for which as of end of 2012 the first sections are undergoing the process of plan approval procedure, including public participation. The proposed plans foresee e.g. 47 km of new track, 74 km of noise protection walls and the replacement of 55 level crossings by 38 new/adapted bridges (DB Projektbau 2011, 2012). However, public debate about the way the project is planned has been growing in Germany as well, and although the mere construction period is expected to last for around two years, only, it is difficult to estimate the actual completion date.

2.1 Methodology and remarks on CBA and project selection

The first assessment of the benefit and cost of the Betuwe line in 1992 concluded that the line would pay back the investment of EUR 2.36 million by the year 2000 and if the line would not be built until 2010 the state would face a loss of potential tax revenues of EUR 5.4 billion (Koetse/Rouwendal 2010 quoting Knight Wendling 1992). This result was obtained using a transport forecast consisting of two scenarios, a baseline and an ambitious scenario that assumed the Betuwe line was part of the ambitious scenario without actually simulating the impact of the Betuwe line. Rather the increase of freight rail demand was taken as given in this "CBA". The TCI report notes about the two rail freight scenarios that it remains unclear how the different forecasts of 40 million t (baseline scenario) and 65 million t (ambitious scenario) have been estimated (TCI 2004, p. 43). Surprisingly the first assessments did either not take into account the environmental benefits of a rail freight line or did conclude that it would bring about very limited environmental benefits such that they could be ignored (Koetse/Rouwendal 2010, p. 9).

The Central Planning Bureau (CPB) also undertook economic analyses of the Betuwe Line. Interestingly the studies in 1993 (CPB 1993) and 1995 (CPB 1995) concluded rather the opposite. The earlier study estimated a payback period of 15 to 20 years. They were also building on the Knight Wendling studies of 1991/1992. The later study concluded that there might have been more beneficial projects than a new Betuwe Line and recommended a phased approach, i.e. start building profitable sections first (e.g. close to the Port of Rotterdam) and then assess again, which other sections would become beneficial (CPB 1995).

However, these assessments were incomplete (e.g. did not apply a proper transport forecast or did not build on a sufficiently detailed cost assessment as the project was not sufficiently specified) so that the Netherlands Court of Audit in the year 2000 still stated "*that a sound and comprehensive cost/benefit analysis of the Betuwe Route is missing.*" (quoted after Vrijland 2004, p.4).

Some discussions about alternatives took place, e.g. to build the whole track in a tunnel or to improve inland waterway transport instead. However, Priemus (2007) argues that these alternatives to the Betuwe line have never been seriously considered by the government, though he acknowledges that various engineering variants of a rail track have been analysed in 1993. Actually the Betuwe line as it has finally been built can be understood as an alternative selection to the very first plans, which had been to renew the existing single track. Instead, most of the track was completely newly constructed, which explains a significant part of the cost differences in comparison to the very first cost estimates of 1990.

2.2 Methodology and remarks on environmental analysis

The environmental impact analysis concentrated on the emissions of air pollutants (e.g. CO, NO_x), while issues like noise, safety or land use have been neglected. Thus the Netherland Court of Auditors concluded that *"Decisions were made on the assumption that the Betuwe Line was strategically important to the economy and environment. Little priority was given to finding policy information to support that assumption."* (Algemene Rekenkamer 2000).

However, the basic decision to build a new track instead of renewing the old track passing through 15 villages indicates that environmental and health concerns associated with settlements have been taken into consideration. Vrijland also reports that noise reduction plans and safety measures have been implemented to take such concerns into account (Vrijland 2004). In that sense, Vrijland also questions the findings of the Netherland Court of Auditors.

2.3 Characteristic of the transport demand scenario and its economic drivers

The transport demand scenario underpinning the economic analyses of the Betuwe Line project seems to be the most flawed aspect of the whole assessment, at least during the 1990ies. Table C2-8 presents the transport forecast as it was used from the earliest assessment by Knight Wendling onwards in assessments of the Betuwe Line. The important number is the difference between 40 and 65 million tons of rail freight in 2010. This covered the whole rail freight and was not specifically estimated testing specifications of the Betuwe Line. Nevertheless, it seems that this general growth was proportionally assigned to the improved Betuwe Line to estimate benefit figures. However, Koetse/Rouwendal conclude that *"an independent assessment that investigated the demand for freight transport over the Betuweroute under particular conditions of price and quality was never conducted."* (Koetse/Rouwendal 2010, p.59).

**Table C2-8: Transport demand scenario underpinning the Betuwe Line decision
Dutch freight demand in [million t]**

Scenario / Mode	1987	2000	2010
Baseline scenario			
Road	456	600	749
Rail	18	32	40
Waterway	234	288	317
Total	707	920	1 106
Ambitious rail scenario			
Road	455	581	715
Rail	18	48	65
Waterway	234	291	326
Total	707	920	1106

Source: TCI 2004, p. 43, quoting the forecast of the Dutch rail operator.

2.4 Investment cost and structure of financing

The first estimate of investment cost of the Betuwe line amounted to EUR 1 134 million in 1990. As Table C2-9 shows the cost continuously increased up to the total construction cost of EUR 4 705 million until 2008, which is an increase of 315%. The cost increases for different reasons, including extensions of the line, mitigating environmental impacts, adaptations of the engineering specifications (e.g. tunnels for double stack trains) and inflation during the planning and implementation. Close to 30% of the cost increase is due to inflation. A more detailed list of the construction-conditioned cost increases is presented by Pestmann (2001).

At the time of the government decision on the implementation of the Betuwe Line the cost estimate has reached EUR 3.67 billion. The cost increase to completion in comparison with that figure would have been EUR 984 million or roughly 27%. This could be split into 67% to consider inflation and about 17% for changes of scope of the project. Less than 10% should be attributable to shortcomings in design or estimations (Vrijland 2004, p.6).

Table C2-9: Cost development of Betuwe line (in EUR million)

No	Date	Issue	Extra cost	Total cost
1	06/1990	Cost estimate with 50% private financing		1 134
2	01/1992	Extension to Rotterdam-harbour (Maasvlakte)	+363	1 497
3	04/1992	Choice of trajectory Maasvlakte-Zevenaar	+838	2 335
4	05/1993	Adaptations to mitigate adverse effects on the environment (local resistance)	+497	2 832
5	09/1993	<i>Mark-up for price inflation</i>	+72	2 904
6	12/1993	Adaptation to parliamentary and provincial demands, Barendrecht now in the project	+335	3 239
7	04/1994	<i>Mark-up for price inflation</i>	+119	3 358
8	1996	Trajectory decision leading to adaptations including four new tunnels	+386	3 744
9	1996-2005	Change of scope due to political decisions (e.g., Dintelhaven bridge, double-stack ready tunnels etc.)	+321	4 065
10	1996-2005	<i>Mark-up for price inflation</i>	+783	4 848
11	01/2006	Cost forecast including risk	-195	4 653
12	12/2008	Reporting of total cost in the EC TENtec system	+52	4 705
		Total cost increase	315%	3 571
		Cost increase due to adaptations of route / engineering	229%	2 597
		Cost increase due to inflation	85%	974

Source: Vleugel/Bos 2008 after ProRail 2006, and own analysis

Though the Betuwe Line is operating since 2007, several projects in connection with the Betuwe Line have been co-funded by the TEN-T funding afterwards. To mention some examples (in brackets the TEN-T EA codes):

- third track in The Netherlands to the Dutch border (2010-NL-92226-S, EUR 0.8 million),
- retrofitting locomotives with ETCS/ERTMS (2007-NL-60380-P, EUR 9 million),
- studies and works on the third track in Germany (2007-DE-24040-P, EUR 47 million).

2.5 Conclusions to be drawn

The Betuwe Line presents a prominent example of a political decision on a transport project, triggered by a stakeholder (i.e. the Port of Rotterdam). Of course, the project fitted in strategic plans promoting the concept of "Mainports", in the Netherlands Schiphol airport and the Port of Rotterdam. But as an ex-post analysis is missing, yet, we can not decide if the project was actually beneficial in socio-economic and financial terms.

However, we have to note that both the transport demand forecast and the ex-ante economic analysis, both in itself and as it builds on a flawed transport forecast, were clearly insufficient to take an informed decision on funding of such a large project.

From the European perspective the project fits well into the strategic transport policy objectives as it promotes rail freight and makes it attractive for long-distance transport on major demand corridors connecting European freight/economic hubs. However, still the socio-economic benefit should be proven by an ex-post analysis, in particular as European funding is provided to complete further sections of the track on both ends.

A useful remark was made by the CPB (1995) who advocated a phased approach to develop the Betuwe Line in a sense that in earlier phases the less costly sections and obviously beneficial ones should be build enabling better informed assessment for the further sections. However, one should take into account still to consider the network topology when developing the first sections.

2.6 References

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ANNEX 3: RAIL BALTICA

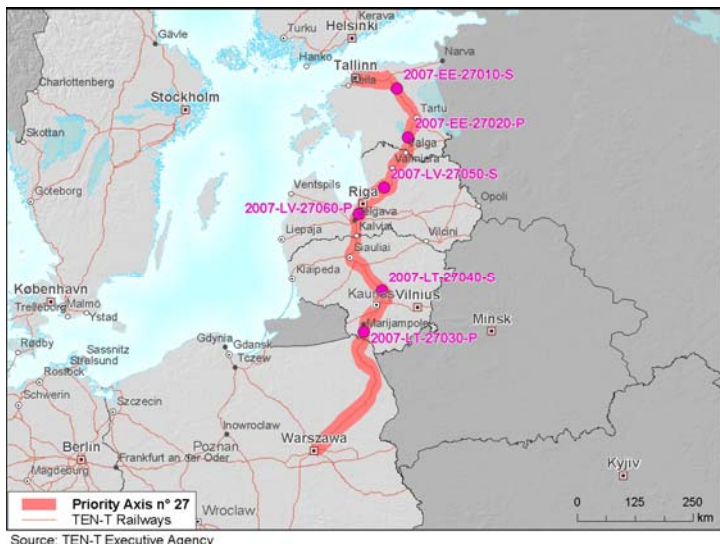
This case study is split into two summaries, each focussing on one major feasibility study on the project Rail Baltica. For each of the studies a summary table is filled and the subsequent sections focus on the specific study.

Table C3-10: Project summary of Rail Baltica: COWI Feasibility Study (2007)

Aspect	Description	Aspect	Description
Project Title	Rail Baltica (Study financed by DG Regional Policy)	TEN-T code	PP27
Countries / area	Poland, Lithuania, Latvia, Estonia	Start date	open
Mode(s)	Railways	End date	open
Managing authority	Various for the different sections (e.g. National Ministries, railway operators), Mr Pavel Telička (European Coordinator)	Duration	Not applicable
		Delay (mth)	Not applicable
Investment cost (m€)	0.98–2.37 bill. Euro (2006)	Length (km)	1190
EC funding TEN-T (m€)	Underlying assumption: EU grants 60% of the total investment costs (TEN-T and cohesion funds)	EC share	60% (TEN-T and cohesion funds)
EC funding Cohes. (m€)	Underlying assumption: EU grants 60% of the total investment costs (TEN-T and cohesion funds)	EC share	60% (TEN-T and cohesion funds)
Funding agent 1	Member States	Value (m€)	0.39-0.95 bill. Euro (2006)
Funding agent 2	EU (cohesion fund and TEN-T fund)	Value (m€)	0.59-1.42 bill. Euro (2006)
Cost-benefit-analysis	COWI Consult	CBA ratio	1.9-2.8 with high values of time ; 40% lower with national VOT
		Public y/n	y
Transport scenario	Three investment scenarios; one reference scenario (forecast year: 2040 (2034))	Dated from	2005
Externality covered	Air pollution; CO2 costs; accident costs	Ext. cost (m€)	246-421 mill. Euro benefits (2006)
EIA	The study highlights main problems and conflicts caused by the proposed investments. Findings need to be studied in more details in EIAs.	Public y/n	y
CIA	Impacts on CO2 emissions are estimated	Public y/n	y

<p>Financial analysis</p>	<p>Financial analysis carried out from the perspective of following three agents:</p> <ul style="list-style-type: none"> • Infrastructure manager • Operator of passenger trains • Operator of freight trains 	<p>Expected RoI</p>	<p>Economic IRR : 9.0-13.3%</p> <p>Financial IRR (on own capital, perspective of infrastructure manager) : 2.6-4.7%, under the assumption of 60% EU contribution for investment costs; without EU finance, none of the options are financially viable</p>
<p>Ex-post evaluation</p>	<p>Not applicable</p>	<p>Cost overrun (m€)</p>	<p>Not applicable</p>

Source: own analysis



“Rail Baltica” is a strategic rail project linking four new EU Member States of the EU - Poland, Lithuania, Latvia and Estonia. In addition, it is the only rail connection between the three Baltic States themselves, to Poland and the rest of the EU. To the north, Helsinki is connected by rail ferry services across the Gulf of Finland. Existing rail tracks in the three Baltic States are implemented in wide gauge. The basic direction of the networks is East-West to enable links to the Baltic ports and from and to Russia.

The length of the current track is approximately 1,200 km by the most direct existing route from Tallinn to Warsaw. A variety of track and operating systems are currently in use: single and double track, electrified and non-electrified (of which single track non-electrified is the most common system). Rail Baltica is thus facing a number of specific challenges, like to combine renewal of tracks with upgrades and new construction (e.g. of double tracks), combining standard gauge with gauge or connecting these two types of networks or improving electrification and signalling along the line.

3.1 Methodology and remarks on CBA and project selection

The Feasibility Study embraces an economic assessment (CBA approach) and financial assessment. It refers to the whole scope of the Rail Baltica corridor from Warsaw to Tallinn.

The economic assessment is based on a traditional CBA approach, following the recommendations by DG Regio’s Guide to cost-benefit analysis of investment project, as

well as recommendations of the HEATCO project. The elements of the applied CBA are as follows:

- Travel time savings (passenger)
- Carriage time savings (freight)
- User costs (passenger)
- User costs (freight)
- Investment costs (rail)
- Scrap value (rail)
- Change in operation and maintenance (road)
- Access charges by operators
- Net operation and maintenance on the rail line
- Net ticket revenues
- Net operation and maintenance for rolling stock
- Access charges for infrastructure managers
- Air pollution
- Climate change (CO₂)
- Accidents

The financial assessment follows the recommendations outlined in DG Regio's Guide to cost-benefit analysis of investment projects and focuses on cost and revenues from the perspective of three different agents:

- Infrastructure manager
- Operator of passenger trains
- Operator of freight trains

The considered cost and revenue elements of infrastructure managers are as follows:

- Investment costs (including scrap value)
- EU funding
- Access charging from operators
- Maintenance costs.

For the financial analysis from the perspective of operators of passenger (freight) trains the following components are considered:

- Net ticket (tariff) revenue
- Net operating costs and maintenance costs of rolling stock
- Access charges to infrastructure manager.

In order to assess the robustness of the obtained results, sensitivity analyses are carried out.

The Study does not intend to select a specific option, but rather to explore the feasibility of different options from a strategic point of view. It concludes with recommendations for the

three specific sections (Talinn-Riga; Riga-Kaunas; Kaunas-Warsaw), under consideration of investment costs, impacts on passenger and freight transport, and environmental issues.

3.2 Methodology and remarks on environmental analysis

The Feasibility Study neither contains an EIA nor a CIA.

However, the study highlights main problems and conflicts caused by the proposed investment packages. The obtained findings need to be studied in more details in EIAs conducted during the detailed design studies.

3.3 Characteristic of the transport demand scenario and its economic drivers

The Feasibility Study covers three investment scenarios for infrastructure developments along the Rail Baltica corridor and a reference scenario (forecast year: 2034). The infrastructure assumptions of the reference scenario are compiled on the basis of national investment plans. The assumptions on the investment scenarios rely on all infrastructure changes of the reference scenario plus the investments related to Rail Baltica. The assumed infrastructure scenarios reveal heavy investments in the road network in all Baltic States and Poland.

Each infrastructure scenario is substantiated by a common socio-economic scenario, covering the main demand triggers: number of inhabitants, motorization, GDP per capita, GDP per economic sector and user costs for transport services. The socio-economic scenario is elaborated by the consortium, under application of results of EU funded projects (TEN-STAC, PRIMES, SCENES) and publications by the European Commission ("European Energy and Transport Trends to 2030").

Transport demand forecasts are generated by the Vaclav (passenger demand) and the NEAC (freight demand) model.

The study was carried out before the financial crisis. Therefore, from today's perspective, the applied GDP growth rates are too optimistic.

3.4 Investment cost and structure of financing

The investment costs are estimated on the basis of

- country-specific costs for land acquisition
- country-specific unit costs for track renewal (upgrade of an existing link to 120 km/h)
- unit costs for upgrade of existing track to 120 km/h
- unit costs for upgrade of existing track to 160 km/h
- new line (broad gauge)
- new electrified line (standard gauge)
- salaries.

The assumed unit costs were verified with a member of the UIC working group involved in the regular update of the report "Infracost – The Cost of Railway Infrastructure".

Maintenance costs are estimated under consideration of following cost components:

- maintenance of the track
- maintenance of the signalling and telecommunication installations
- maintenance of the overhead line
- maintenance of surrounding areas.

The project is assumed to be financed by 60% from EU funds (TEN-T and cohesion funds).

The Economic IRR is estimated to be in the range of 9.0-13.3% (depending on the investment option).

The Financial IRR on own capital is estimated to 2.6-4.7%, depending on the investment package. It is calculated for the perspective of the infrastructure manager, under assumption that 60% of the investment costs are covered by EU budgets. Without EU financing, none of the options are financially viable.

3.5 Cost developments over the life-cycle of the project

The components of investment and maintenance cost estimations are listed in the section above.

Operating costs were considered on the basis of the maintenance cost components, whereas revenues were estimated on the basis of demand forecasts and applied access charges in Poland.

Table C3-11: Project summary of Rail Baltica : AECOM study (2011)

Aspect	Description	Aspect	Description
Project Title	Rail Baltica	TEN-T code	PP27
Countries / area	(Poland,) Lithuania, Latvia, Estonia The Study refers to the Baltic part of the Rail Baltica corridor	Start date	Open
Mode(s)	Railways	End date	Open
Managing authority	Various for the different sections (e.g. National Ministries, railway operators), Mr Pavel Telička (European Coordinator)	Duration	Not applicable
		Delay (mth)	Not applicable
Investment cost (m€)	EUR 3 539 million ('best feasible option') without design and planning, project management, site supervision and VAT. With above positions EUR 3 780 million.	Length (km)	728 km ('best feasible option')
EC funding TEN-T (m€)	Underlying assumption: EU grants 56.3% of the total investment costs (85% of the investment costs to which co-financing rate for priority axis applies)	EC share	56.3%
EC funding Cohes. (m€)	Underlying assumption: EU grants 56.3% of the total investment costs (85% of the investment costs to which co-financing rate for priority axis applies)	EC share	56.3%

Funding agent 1	EU (various sources)	Value (m€)	1.992 billion Euro (without design and planning, project management, site supervision and VAT)
Funding agent 2	National funds by Baltic States, other sources	Value (m€)	1.547 billion Euro (without design and planning, project management, site supervision and VAT)
Cost-benefit-analysis	AECOM	CBA ratio	1.75
		Public y/n	y
Transport scenario	Four different alignment schemes on the corridor are drafted, but the main assessment results refer to the identified 'best feasible option'	Dated from	2011
Externality covered	Air pollution; safety (accidents); climate change	Ext. cost (m€)	EUR 828 million benefits (discounted)
EIA	The study contains a chapter on environmental considerations, in which effects on Natura 2000 sites, noise impacts, impacts on rivers, water courses and on cultural heritage are discussed.	Public y/n	y
CIA	Impacts on CO ₂ emissions are estimated.	Public y/n	y
Financial analysis	Financial analysis carried out from the perspective of following three agents: <ul style="list-style-type: none"> • Infrastructure manager • Operator of passenger trains • Operator of freight trains 	Expected RoI	Economic IRR : 9.3% Financial IRR (from the perspective of the infrastructure manager) : 0.05%, without EU contribution
Ex-post evaluation	Not applicable	Cost overrun (m€)	Not applicable

Source: own analysis

3.6 Methodology and remarks on CBA and project selection

The Study embraces an economic assessment (CBA approach) and financial assessment, and relates to the Baltic part of the Rail Baltica corridor between the Lithuanian/ Polish border and Tallinn.

The methodology applied is in line with the method set out in DG Regio's Guide to cost-benefit analysis of investment projects, and incorporates "in some way" input from the Railway Project Appraisal Guidelines by the EIB, the HEATCO project and the IMPACT study,

the letter both carried out on behalf of the European Commission. The elements of the applied CBA are as follows:

- Capital costs
- Maintenance costs
- Track access charges
- Residual value of the project
- Operating and maintenance costs
- Revenues from customers
- Travel time savings
- Accident costs
- Air pollution
- Greenhouse gases.

The financial assessment focuses on cost and revenues from the perspective of three different agents:

- Infrastructure manager
- Operator of passenger trains
- Operator of freight trains.

The considered cost and revenue elements of infrastructure managers are as follows:

- Investment costs
- Residual value
- Access charges from operators
- Maintenance costs.

For the financial analysis from the perspective of operators of passenger (freight) trains the following components are considered:

- Revenues
- Operating costs (including track access charges).

The obtained results are subject to a risk analysis, embracing sensitivity tests, the identification of critical variables, and the application of probability distributions to key variables.

The 'best feasible option' is identified on the basis of passenger and freight demand (volumes, revenues, time savings, CO₂ / GHG savings) and other 'key factors'. The identified option represents the most direct and shortest route from the southern-most point to the northern-most point of the corridor.

3.7 Methodology and remarks on environmental analysis

The study neither contains an EIA nor a CIA.

However, the study contains a chapter on environmental considerations, in which effects on Natura 2000 sites, noise impacts, impacts on rivers, water courses and on cultural heritage are explained.

3.8 Characteristic of the transport demand scenario and its economic drivers

The transport demand scenario takes into account the following exogenous developments: population, GDP, GVA and trade/ commodity flows. Exogenous trends were derived from information by national statistical offices of each Baltic State, Eurostat and the UN. Passenger demand forecasts are driven by changes in number of inhabitants and GDP per capita, whereas freight demand forecasts are determined by GDP growth. The reference infrastructure scenario underlying the appraisal results is not presented in an explicit way.

Current transport services for all modes are assessed by a five point scoring system.

The study was carried out after the financial crisis. The applied GDP growth rates seem realistic.

Nevertheless the results for passenger transport development are substantially and for freight transport modestly higher than in the COWI-study. This is hard to understand because matrix information on the OD-flows is not given in a comprehensive form. Furthermore, it is not clear which assumptions have been made on the infrastructure provision for competing transport modes (car, air). As the population will be declining the forecasted growth of passenger transport can be generated in the first instance by increased travel distances (change of destination) and increased preference for rail transport (change of modal split). However, the study does not give precise answers with respect to these questions.

3.9 Investment cost and structure of financing

The estimation of construction costs is based on the CAPEX Unit Cost Methodology. For application of this approach, the entire alignment is divided into 27 segments of various lengths. The costs for land acquisition differentiate between type of territories (forest, field, swamps), major cities along the route, and villages.

Maintenance costs are estimated under consideration of following cost components:

- maintenance of the track
- maintenance of the signalling and telecommunication installations
- maintenance of the overhead line
- maintenance of surrounding areas.

The project is assumed to be financed by 56.3% from various EU funds.

The Economic IRR is estimated at 9.3%.

The Financial IRR amounts to 0.5%, from the perspective of the infrastructure manager, and under the assumption that no EU contribution is made.

3.10 Cost developments over the life-cycle of the project

The components of investment and maintenance cost estimations are listed in the section above. Infrastructure operating costs were considered on the basis of the maintenance cost components, whereas revenues from infrastructure charges were estimated on the basis of demand forecasts. Access charges are determined on the basis of the EU document on the establishment of a single European railway area (2010/0253(COD)). Operating costs by operating companies are driven by fuel costs, labour costs, total cost of rolling stock, overhead costs and track access. The cost figures of the two studies are not comparable because of different design of infrastructure alternatives and demand/operation figures.

3.11 Compliance of detailed planning with Rail Baltica definition

The following information in Table C3-12 was received from TEN-T EA concerning EU supported planning activities for Rail Baltica.

Table C3-12: Project summary of Rail Baltica: COWI Feasibility Study (2007)

Project Number	Section	Country	Planning activity for	Budget EUR million	EU-support percent
2007-LV-2760-P	Joniskis-Jelgava-Sigulda-Valga	Latvia	Reconstruction Upgrade	43.5	23.15 %
2007-LV-2750-S	Joniskis-Riga-Valga	Latvia	Studies for EU gauge	2.2	50 %
2007-LT-27040-S	PL/LT border-Kaunas-LT/LV border	Lithuania	Upgrade ex. tracks Contribution to global study on EU gauge	32.1	50 %
2006-LT-92401-S	PL/LT border – Marijampole	Lithuania	Preparation of territorial documents	canceled	-

Source: TENTec information system, own analysis

According to a decision of Prime Ministers of the three Baltic States (Nov. 2011) the “best option” of the AECOM Feasibility Study (“red line option”) is supported. This foresees the construction of a standard gauge track with a design speed of 240 km/h for passenger trains and a straight alignment from the PL/LT border to Talinn which deviates from the sections of the above list north to Kaunas. This implies that the activity in the top row is not needed for Rail Baltica, as well as parts of the third row. As the main part of these activities is planned until the year 2015 it remains unclear if the funding will be stopped or changed to co-finance plan preparations alongside the favoured “red line”.

ANNEX 4: CROSS-BORDER RAILWAY ZALALÖVŐ– BAJÁNSENYE–HODOŠ–MURSKA SOBOTA (PAN- EUROPEAN CORRIDOR V, SLOVENIA HUNGARY)

Table C4-13: Project summary Cross-Border Railway Sections Slovenia-Hungary

Aspect	Description	Aspect	Description
Project Title	Railway construction Zalalövő–Bajánsenye–Hodoš–Murska Sobota	TEN-T	Part of Pan-European Corridor V which is now the Eastern part of TEN-T Priority Project 6
Countries area	Hungary, Slovenia	Start date	1996
Mode(s)	Rail	End date	2003
Managing authority	State railways of Hungary and Slovenia	Duration	7 years
		Delay (mth)	-
Investment cost (m€)	originally planned: 133.7; effective: 203.3	Length (km)	Hungary : 19.6 Slovenia : 24.5
EC funding (PHARE) (m€)	Hungary – Phare funds: 1999-2000: 10	EC share	-
EC funding Cohes. (m€)	-	EC share	-
Funding agent 1	State of Hungary + foreign loan (KfW)	Value (m€)	1996-2003 : 23.54 (budget) ; 61.78 (KfW)
Funding agent 2	State of Slovenia + loan by consortium of Slovene banks	Value (m€)	1996-2003 : 14.74 (budget) ; 93.22 (loan)
Cost-benefit-analysis	<p>(1) Sir Alexander Gibb & Partners: Slovenia – Hungary Rail Link Feasibility Study, Final Report, June 1995 (not available)</p> <p>(2) Ministry of Transport of the Republic of Slovenia and the Ministry of Transport, Communication and Water management of the Republic of Hungary: Slovenia – Hungary Railway Line/ Joint Cost Efficiency Analysis, September 1996 (not available)</p> <p>(3) Republic of Hungary, State Audit Office ; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003</p>	CBA ratio	<p>Following figures from source (3): <i>EIRR: econ. rate of return; EBC: econ. cost-benefit ratio; ENPV: econ. present value; SDR: social discount rate;</i></p> <p>Hungary: Before: EIRR: 12.50% EBC ratio: n.a. ENPV: 53.74 m€ (6% SDR); 14.41 m€ (10% SDR) After: EIRR: 9.36% EBC ratio: n.a. ENPV: 28.61 m€ (6% SDR); -2.75 m€ (10% SDR)</p> <p>Slovenia: Before: EIRR: 12.39% EBC ratio: n.a. ENPV: 43.19 m€ (6% SDR); 11.27 m€ (10% SDR) After: EIRR: 8.16% EBC ratio: n.a. ENPV: 16.81 m€ (6% SDR); -3.43 m€ (10% SDR)</p>
		Public y/n	Y

Transport scenario	Republic of Hungary, State Audit Office ; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalaalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003	Dated from	2003
Externality covered	not available	Ext. cost (m€)	not available
EIA	not available	Public y/n	n
CIA	none	Public y/n	-
Financial analysis	Republic of Hungary, State Audit Office ; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalaalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003	Expected RoI	Dynamic time of return : Hungary: Before: 13 years (6% SDR); 17 years (10% SDR) After: 19 years Slovenia: Before: 14 years (6% SDR); 18 years (10% SDR) After: 20 years
Ex-post evaluation	Republic of Hungary, State Audit Office ; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalaalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003	Cost overrun (m€)	almost 30% compared to start of works estimate (Hungary: +10%, Slovenia: +53%)

Source: own analysis

Figure C4-3 : Cross-border railway project Zalaalövő–Bajánsenye–Hodoš–Murska Sobota



Source: Audit Report (2003), p.8.

The main line of the Pan-European Corridor V extends the European Union’s Trans-European Transport Network from Italy (Venice) through Slovenia and Hungary to the south-western part of Ukraine. In 2004, following the accession of both Hungary and Slovenia to the EU, Corridor V was integrated into the “Mediterranean Corridor” (Priority Project n° 6). By that time, the cross-border railway section between Hungary and Slovenia

had already been completed. The main rationale for this project was a direct railway link for passenger and freight trains, avoiding transit through Croatia.

It is worthwhile taking a closer look at the planning and implementation of this bi-national cross-border project (see the above fact sheet):

At the end of the year 1993 the Ministries of transport from both countries signed a Letter of Intent for re-establishing the railway connection. In 1995 the agreement on railway construction was signed. A Joint Interstate Committee (Slovene–Hungarian) was established with the purpose of managing and co-ordinating construction preparations. In 1996 the countries adopted finalised decision on railway construction and in October 1996 the agreement on establishing railway connection was signed. The main objectives were to enable the cargo and passenger traffic between the countries, to improve the traffic links between the Western and Central and south-eastern Europe and to create conditions for development of better co-operation between the two countries. Construction works of the Murska Sobota–Hodoš–Bajánsenye–Zalalövő line commenced in 1996 and were completed in 2003. The introduction of the railway line brought to the local people a new, economical link and a cheaper public service of the passenger traffic. Nevertheless on the basis of first year traffic data it was found that the capacities of the passenger trains are used in less than 5 %.²³

As the two countries had adopted an agreement on co-operation when planning and realising the investment, the State Audit Office of the Republic of Hungary and the Court of Audit of the Republic of Slovenia carried out a joint audit of the investment. The audit reviewed apart from regularity of planning the investment public procurement process and financing the investment, also the ecological aspect of railway construction and other impacts of the investment.²⁴

As the main assessment documents (feasibility study, CBA, environmental studies) of this project were not available for our assessment, most information was extracted from the audit report (referred to below as the Audit Report (2003)).

4.1 Methodology and remarks on CBA and project selection

The CBA report was not available for this assessment. The audit report explains the process of choice of the final alignment (see above). According to this report, the Feasibility study used data from 1993 for the cost–benefit assessment. Therefore the countries carried out another analysis of investment costs and benefits before undertaking the investment. They also wanted to ensure the data to be comparable between the countries. On the basis of unified points they prepared a Joint Cost Efficiency Analysis for the whole project. This analysis presents calculated internal profit level, net current value and investment return period. A sensitivity test of the project was prepared in line with the parameters which presented most risky parts of the project (changes in scope of cargo transit, investment costs and changes in state budget preference).

The CBA assessed the costs of railway track construction for three different variants of railway track which allow different speed limits, and prepared freight demand forecasts, economic evaluations in terms of the costs and benefits and assessed the expected environmental impacts. Investment costs were assessed for three different routes including

²³ Republic of Hungary, State Audit Office ; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003, p. 61.

²⁴ Ibidem, pp. 7-10.

the facts that the railway would be a single track and not electrified in the first phase, that six intermediate stops or bypasses and border crossing station will be constructed, that level crossings on all crossroads will be arranged. In order to calculate the economic efficiency indicators, the study assessed the benefits of the constructed railway.

The economic efficiency indicators (EIRR, ENPV and dynamic time of return) have deteriorated during the investment implementation, because of increased investment costs. Even though the countries used a unified basis for assessing costs and benefits that were defined before the investment implementation, the calculations of economic efficiency indicators were not based on the same elements. Calculation of IRR, NPV and Dynamic Time Return indicators in Hungary were based on the effective and increased investment costs. In Slovenia the indicators were calculated on the basis of the planned investment costs. Because the countries used basis which were not unified for the recalculation of cost efficiency, the indicators are not fully comparable.²⁵

“Three possible routes for a new railway link were originally proposed:

- Murska Sobota–Hodoš–Bajánsenye–Zalalövő
- Lendava–Rédics
- Murska Sobota–Martinje–Szentgotthard.

Both countries started carrying out preparations for the construction. Even though the preparatory work was completed, the Hungarian Ministry for Environmental and Regional Policy issued in March 1993 a negative opinion on the railway construction because of its damaging impacts on the natural environment. The second variant of the railway link Lendava–Redics was also rejected. One of the reasons was that on Hungarian side there were too many deteriorated railway lines which would require renovation. In addition on the Slovenian side it would not be possible to complete the railway track entirely on Slovene territory. After the two variants were rejected both countries supported the construction of the railway route: Murska Sobota–Hodoš–Bajánsenye–Zalalövő, which is partly following the original and an abandoned railway link.”²⁶

A “cost efficiency study” was carried out in the year of start of construction (Ministry of Transport of the Republic of Slovenia and the Ministry of Transport, Communication and Water management of the Republic of Hungary: Slovenia – Hungary Railway Line: Joint Cost Efficiency Analysis, September 1996). This report was, however, not available for our assessment.

4.2 Methodology and remarks on environmental analysis

In accordance with the Slovene and Hungarian legislation which defines the environmental protection and also provides for that the railway track shall be constructed in a way which will assure minimal negative impacts on nature, the Feasibility study presented possible impacts of railway construction and operation on air quality, agricultural land, soil and preservation areas along the new railway track, impacts caused by railway noise, impacts on natural and cultural heritage, flora, fauna and ecosystems, underground water and surface water.²⁷

²⁵ Audit report (2003), p. 30.

²⁶ *ibidem*, p. 9.

²⁷ *ibidem*, p. 47.

Before the start of the railway construction in Hungary the nature protection official approval was issued. When designing and constructing the railway line all nature protection demands were considered. The most attention was paid to mitigation of negative impacts of noise, vibration and dust.

In Hungary the attention was paid to preservation of existing habitats. Due to unique biochemical structure of the ground, a couple hectares of sod were transposed; along the railway line 8.8 km of fence for deer protection was set up. In Slovenia a lot of funds were used for setting up noise barriers, removal of pheasant hatchery and creating passages for amphibians.²⁸

4.3 Characteristic of the transport demand scenario and its economic drivers

The only information on the traffic scenario is shown in the table below from the audit report. Sir Alexander Gibb & Partners, a UK consultancy (1995) developed the main governing assumptions (Population, GDP).

Table C4-14: Predicted goods transport volumes on the new railway line (million net tonnes per year)

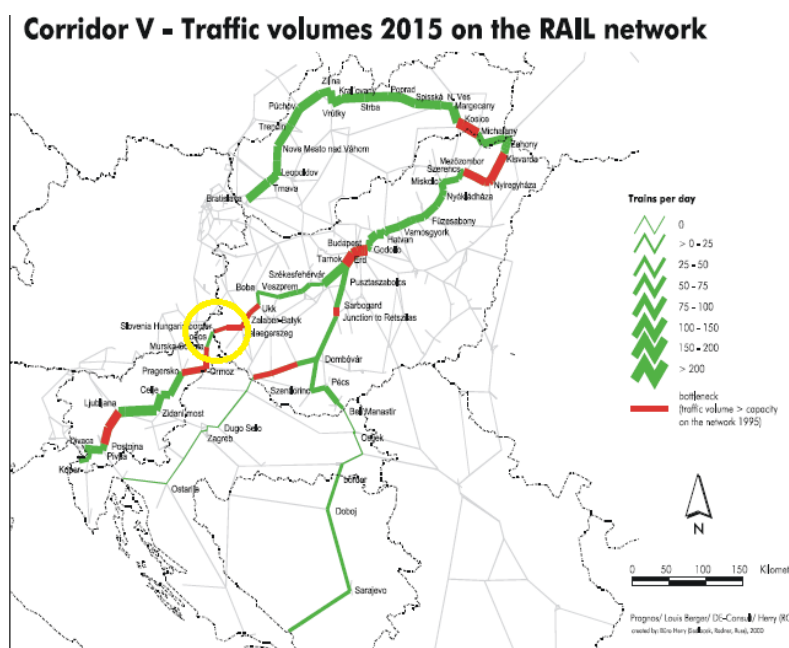
Predicted quantities of cargo transit via new railway line in the study (million net tons/year)			
Type of transport	2000	2005	2015
Direction from the existing railway line:	1,53	2,34	3,72
Direction from the roads:	0,58	0,67	0,94
Total	2,11	3,01	4,66
Referred to:			
– Export	0,13	0,18	0,28
– Import	0,42	0,57	0,84
– Transit	1,56	2,26	3,54

Source: Audit Report (2003), p. 52

At the time of construction of the railway line, a in-depth traffic study was carried out under the EU "Phare" programme for the main corridor and the three branches of Corridor V. This study identified capacity problems on the cross-border section by 2015 (see figure below). It is unclear to which extent the planned capacity of the line then under implementation was taken into account. The mentioned Phare study can be considered as an endorsement of the traffic forecast.

²⁸ ibidem, p. 48.

Figure C4-4 : Rail goods traffic forecast 2015 on corridor V and branches (trains per day)



Source: Prognos et al.: Development of Branches on Corridor V, Phare Multi-Country Transport Programme, Final Report, General Report, September 2000, p. 39

4.4 Investment cost and structure of financing

Before the start of the investment implementation the investment programmes referred to railway construction were prepared for both countries. The investment programmes assessed required investment costs and construction time schedule. The investment programme identified the financial sources for railway construction and the schedule of the needed financial sources. During the investment realisation the investment costs increased which had an impact on alteration of financial sources and the time schedule of financing the project. The countries identified the following sources: state budget and loans, the Hungarian Government also obtained Phare funds (pre-accession instruments financed by the European Union to assist the applicant countries of Central and Eastern Europe in their preparations for joining the European Union).

Table C4-15 : Funding of the new railway line by year and country (million Euro)

Financial sources according to the years and countries milliö EURO*							
Year	HUNGARY				SLOVENIA		
	Budget	Loan	Phare funds ECU	Total	Budget	Loan	TOTAL
1996	0,76	–	–	0,76	0,11	–	0,11
1997	4,74	–	–	4,74	4,59	–	4,59
1998	0,32	0,82	–	1,14	2,73	–	2,73
1999	0,07	25,88	7,50	33,45	1,75	9,45	11,20
2000	0,19	29,84	2,50	32,53	5,56	50,32	55,88
2001	15,85	5,24	–	21,09	0	23,93	23,93
2002	0,66	–	–	0,66	0	9,52	9,52
2003	0,96	–	–	0,96	–	–	–
TOTAL	23,54	61,78	10,0	95,32	14,74	93,22	107,96

* The values in EUR represents the HUF and SIT values converted on the yearly average rate of exchange.

Source: Audit Report (2003), p.29

According to the ex-post audit, the dynamic time of return (payback period) is 19 years for the Hungarian section and 20 years for the Slovenian section. These figures were, however, calculated on the basis of forecast traffic as no actual annual traffic results were yet available.

4.5 Cost developments over the life-cycle of the project

Hungary

The investment programme for railway construction in Hungary was prepared in 1997. The investment costs (excl. PHARE funds) amounted to HUF 14 billion in constant prices of 1996 (EUR 73.2 million), or HUF 21.6 billion (EUR 85.4 million) in current prices. For the period from 1996 to 1997 the funds amounted to HUF 180 million were planned for obtaining approvals, preparation of the investment programme, implementation plans referred to lighting – safety devices and telecommunication devices and for land purchase. Due to the fact that the technical part of investment could not be defined without detailed plans, the investment programme as a base for financial sources was later on several times amended. In 1998 the preparatory construction works began. Due to more precise definition of the technical part of investment, the statement of investment costs amounted to HUF 21 626 million (EUR 85.4 million). In this amount a loan of HUF 15 845 million (EUR 61.8 million), raised at the German financial institution **Kreditanstalt für Wiederaufbau (KfW)**, is included. In order to implement the construction of the railway track, the Hungarian government obtained Phare funds in the amount of HUF 2 545.9 million (EUR 10.0 million). Together with these funds, the total amount of financial resources for the Hungarian part of the railway track increased up to amount HUF 24 140.9 million. In 2000 changes in the investment programme occurred but the planned investment costs did not increase. There were HUF 5 billion (EUR 19.2 million) assured by the state budget for that year.²⁹

Slovenia

The investment programme for railway construction in Slovenia was prepared in 1996. The project value amounted to SIT 13 092.5 million (EUR 79.8 million) in current prices or SIT 10 676.4 million (EUR 65.1 million) in constant prices. In 1997 there was an increase in investment value by SIT 3 267 million according in constant prices. This was the result of additional demands of local communities (in the amount of SIT 967 million) and planned indemnity for expropriated land (in amount of SIT 2 300 million). The new value of the investment amounted to SIT 13,679 million (EUR 83.4 million) in constant prices or SIT 18 320 million (EUR 94.3 million) in current prices. In 2000 the project value was increased again due to unpredicted construction work connected with excavations of SIT 2 513.3 million, to the introduction of VAT amounting to SIT 2 095.3 million and to the assessment of liabilities in amount of SIT 709.8 million (in constant prices). The new investment value amounted in total SIT 17,115.4 million (EUR 104.4 million) in constant prices or SIT 22 333 million (EUR 108 million) in current prices. The government of the Republic of Slovenia decided, when adopting the budget, that the planned investment funds will be assured in the budgets for the period between 1996 and 1999 in line with planned time schedule of expenditures. When the investment value increased in 1997 the government again decided to assure the investment funds in line with the increased value in the state budget. But the decision was not realised, because the budget for 1997 did not include funds of the planned amount, furthermore the funds were not planned also for the next years. Therefore in 1999, the Slovenian Railways took up a loan guaranteed by the State at a consortium of Slovene banks in the amount of SIT 13 233.2 million (EUR 64.8 million) and in 2000 due to increase of investment costs the Slovenian Railways took up a loan in the amount of SIT

²⁹ Audit Report 2003, pp. 31-33.

6 265.5 million (EUR 28.4 million). Due to the decision of the Government on financing the investment by a loan and not by budgetary funds as planned at the beginning, or other sources, the State will have to assure SIT 36 797 million for project realisation and settling debts which represents 35.2 % more funds than planned.³⁰ Additional costs and inflation were taken into account. However, there is no information on operating costs. Infrastructure charging was not required at the time (before accession to the EU).

4.6 TEN-T programme 2007-2013

The TEN-T programme 2007-2013 lists a total of 13 approved projects (see appendix 1) related to the Priority Project n° 6 east of Venice (Corridor V). Except works on the Trieste – Divaca section, all of these are technical and design studies. All projects including the construction of the Italian-Slovene cross-border section are funded by The European Commission at 50 percent.

We have not been able to obtain a clear and up-to date picture of the status of planning of the various sections in Slovenia and Hungary nor on assessment studies for the section Trieste – Divaca under construction.

However, we obtained from the Slovenian Transport Ministry studies concerning the electrification of the railway line Pragersko-Ormož-Murska Sobota-Hodoš-state border. This electrification project also covers the Slovenian part of the cross-border section of the railway line constructed between 1998 and 2003. The basic aim of the electrification and reconstruction of the railway line Pragersko - Hodoš is increasing of the capacity of the line with the shift from diesel to electrical traction on the whole line, at the upgrading of the line and the partial reconstruction of the catenary, which shall enable better line capacity. The feasibility study contains all relevant assessments: financial analysis, economic analysis, sensitivity analysis, risk analysis and an updated traffic forecast.³¹

In the course of the implementation of the electrification project, the Slovenian Transport Ministry noticed some cost changes. The main reason for those changes is the situation on the EU market. The process of public procurement is much different than a few years ago, mainly due to the crisis. The whole project is to be co-financed by the European Union (TEN-T) and the state budget.

A detailed analysis of the content of the feasibility study was not possible as the documents were received after closure of drafting the case study.

³⁰ Audit Report, pp. 33 and 34.

³¹ Prometni Institute (2011): Reconstruction, electrification and upgrading of the railway line Pragersko – Hodoš for 160 km/h, modernisation of level crossings and construction of subways on railway stations, Ljubljana

Appendix 1: TEN-T Projects 2007-2013 on Corridor V

TEN-T code	Country	Project-title	Total Budget (mEUR)	Total EU Contribution (mEUR)	EU Contribution (%)
2010-SI-92232-S	Slovenia	Elaboration of the executive design for upgrading of the section of the railway line Poljčane-Pragersko	2.2	1.1	50
2008-SI-92401-S	Slovenia	Working out of preliminary studies for the construction of the new line of high capacity/high speed line Ljubljana-Zidani Most	0.7	0.35	50
2008-SI-92400-S	Slovenia	Working out of preliminary studies for the construction of the new line of high capacity/high speed line Divača-Ljubljana	0.7	0.35	50
2007-IT-06020-S	Italy	Section Ronchi Sud-Trieste: Priority Project 6 - national section	48	24	50
2007-HU-06100-S	Hungary	Studies for preparation of approval of the railway line section Budapest-Keleti-Miskolc-Nyiregyhaza	16	8	50
2007-EU-06030-S	Italy / Slovenia	Cross-border railway line Trieste/Divaca: study and design of the Trieste-Divaca-Ljubljana-Budapest-Ukrainian border	101.4	50.7	50
2006-HU-92204-S	Hungary	Preparation of Detailed Design and Tender Documentation (Infrastructure and Signalling) for the Implementation Works of the Railways Line Szekesfehervar-Boba	8.8	4.4	50
2006-HU-92202-S	Hungary	Preparation of Design and Tender Documentation for Railways Station Szolnok, Detailed Design and Tender Documentation for Railways Line Debrecen-Záhony, Preparation activities for ETCS2 and for Sub-Stations for Szajol-Záhony Railways Line Section	7.5	3.75	50
2005-IT-90901-S	Italy	New AV/AC line Venezia-Trieste-(Lubiana) in Italian territory: sections project	4.5	2	44.4
2004-SI-92701-S	Slovenia	Technical documentation for the construction of the 2nd track of the railway line Divaèa-Koper	19.4	5.47	28.2
2004-IT-90905-S	Italy	New AV/AC Venezia-Trieste-(Lubiana) line in italian territory: section project	8	3	37.5
2004-HU-92203-S	Hungary	Study on the rehabilitation of the railway line section Székesfehérvár-Boba	5	2	40
2004-HU-92202-S	Hungary	Study on the rehabilitation of the railway line section Szajol-Záhony	18	6	33.3

Appendix 2 : Sources

Year	Type	Title
2011	Feasibility Study	Prometni Institute Ljubljana (2011): Reconstruction, electrification and upgrading of the railway line Pragersko – Hodoš for 160 km/h, modernisation of Level crossings and construction of subways on railway stations.
2003	Audit report	Republic of Hungary, State Audit Office; Republic of Slovenia, Court of Audit (Zsigmond Bihary and Zdenka Vidovič (ed.)): Audit report on railway construction Zalalövő–Bajánsenye–Hodoš–Murska Sobota, Budapest 2003
2000	Pre-feasibility Study	Prognos et al.: Development of Branches on Corridor V, Phare Multi-Country Transport Programme, Final Report, General Report, September 2000
1996	Cost Efficiency Analysis	Ministry of Transport of the Republic of Slovenia, Ministry of Transport, Communication and Water Management of the Republic of Hungary: Slovenia – Hungary Railway Line: Joint Cost Efficiency Analysis, September 1996
1995	Feasibility Study	Alexander Gibb & Partners: Slovenia – Hungary Rail Link Feasibility Study, Final Report, June 1995.

ANNEX 5: WEST COAST MAIN LINE (WCML)

Table C5-16: Project summary of West Coast Main Line

Aspect	Description	Aspect	Description	
Project Title	Reconstruction and modernisation of the WCML (Upgrade and new construction)	TEN-T code	PP 14 TENtec: 1400	
Countries / area		United Kingdom (UK)	Start date	1996 (1998)
Mode(s)		Rail	End date	2003 (2008)
Managing authority		Railtrack Network Rail Strategic Rail Authority	Duration	11 years
			Delay	5 years
Investment cost (m€)	12 444 (roughly 75% renewal)	Length (km)	850	
EC funding TEN-T (m€)	80	EC share	0,6 %	
Funding agent 1	State Budget	Value (m€)	12 364	
Funding agent 2	TEN-T Financing	Value (m€)	80	
Cost-benefit-analysis	Planned works as of 2003 by Strategic Rail Authority (2003) , checked by National Audit Office (2006)	CBA ratio	2.4, (1.7)	
		Public y/n	Y, (Y)	
Transport scenario	In 2003 the transport scenario expected demand growth of 15-25% by project	Dated from	Regular updates	
Externality covered	Feasibility study 1994: heritage, etc. Strategic Rail Auth. 2003: CO ₂ , pollution	Ext. cost (m€)	(0) 75	
EIA	Rather scoping EIA, only	Public y/n	Y	
CIA	Climate impacts of modal-shift to rail	Public y/n	Y	
Financial analysis	Feasibility study 1994: rail operators	Intern. rate of return	9.6 to 12.5%	
Ex-post evaluation	Feasibility study 1994 compared to 2009 Strategic Rail Authority 2003: compared to 2009	Cost over-run (m€)	9,400	
			570	

Source: TENtec Information System 2012, National Audit Office 2006, own analysis

The west coast main line (WCML) is the most important trunk route in the United Kingdom's rail network with some 2,000 train movements per day. It links London from London Euston Station and the south-east of England with England's other largest conurbations (Birmingham and Manchester), as well as with Liverpool, north Wales, north-western England, Cumbria and Scotland, covering a distance of 850 km. Building the WCML dates back to the 1830`s. Since 1960`s the line is electrified. In 1994 the line connected counties with about 16 million inhabitants and generated 12% of all revenues of railtrack by serving 5 billion pkm and 5.5 billion tkm. When the feasibility study, on which the decision to invest in WCML upgrade was building, was carried out, the WCML had a length of about 1100 km and comprised about 3000 km of track (Railtrack, WCML-MDCL 1994).

The WCML is listed as Priority Project 14 of the Trans-European Transport Network (TEN-T). In London, the upgraded line can connect with the Channel Tunnel rail link (Priority Project 2 of TEN-T), enabling the development of further through services between the UK and mainland Europe. Maximum speed before upgrade was 175 km/h and on many sections lower speeds were allowed, only, due to Permanent Speed Restrictions (PSR) caused by curvature, topography or to small distance between parallel tracks. The WCML project should increase maximum speeds and eliminate PSRs such that it was expected to cut passenger and freight journey times between Ireland, Scotland, the north of England and France, Belgium, the Netherlands and Germany. Improved speed and convenience are expected to attract new users on the international routes, helping to shift traffic from the roads and from air transport. Journey times from London to Manchester and Glasgow will be reduced to 2 hours, and around 4 hours 15 minutes respectively.

Chronology – West Coast Main Line (WCML)

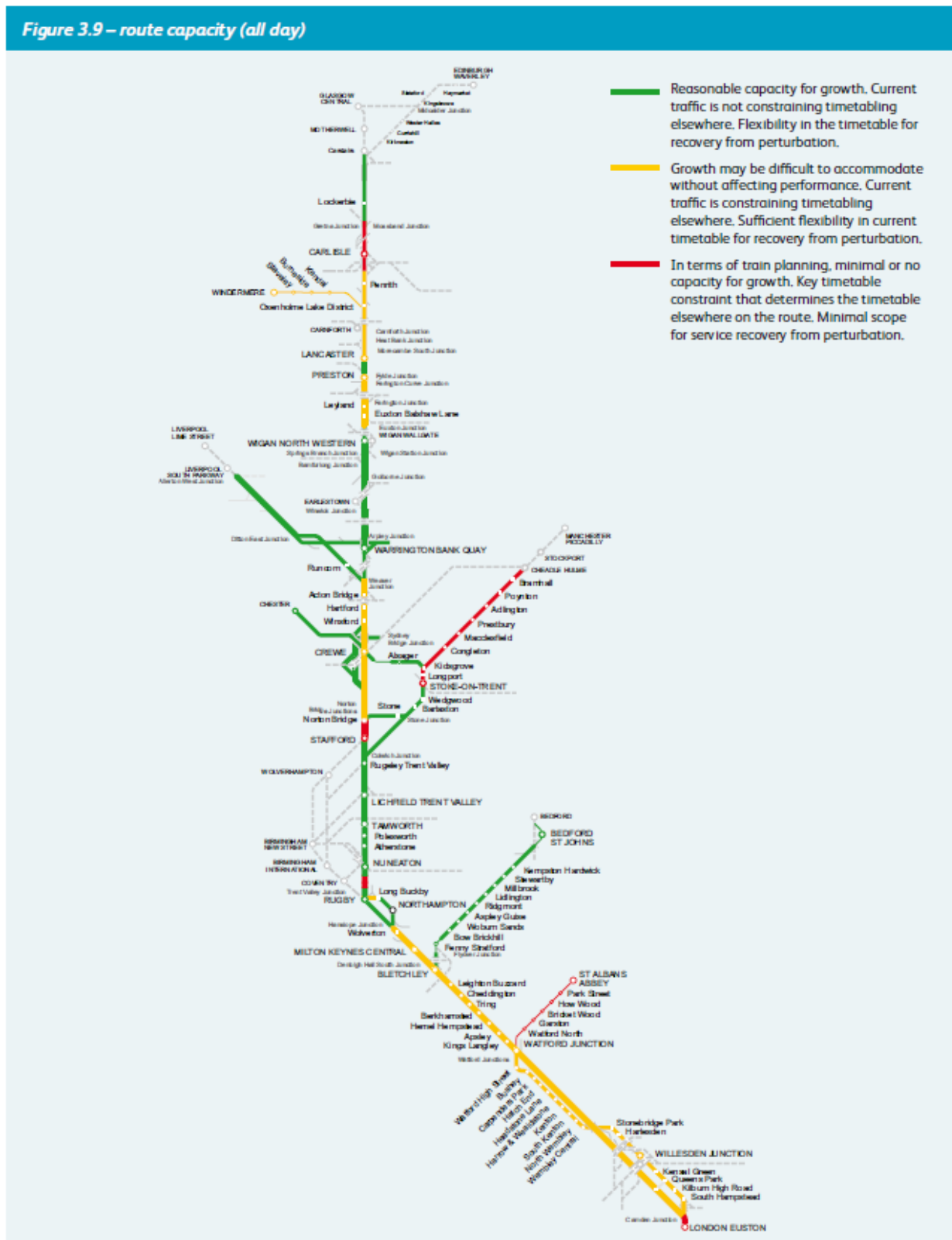
Starting in 1833, the West Coast Main Line (WCML), which is actually a network of lines in the western part of England and Scotland, was built in the 1830`s and 1840`s as first intercity railway trunk in the world. In the 1960`s, the lines were electrified and the possible speed for trains was improved until the mid-1980`s, but there was no reconstruction of the lines until then.

In 1992, the Hesketh report recounted the deterioration of the lines signalling. In 1994, Railtrack took over the British rail network from British Rail and commissioned a group of consultants to develop a plan to modernise the WCML. Their plan envisaged upgrading the line to a speed up to 225 km/h (140 mph) by, amongst other measures, installing the premature moving block signalling technology. Afterwards two competing signalling companies were entrusted with the development.

In Oct. 1997, Railtrack and Virgin Railways signed a treaty that scheduled reconstruction of the WCML and providing it with moving block technology (ERTMS Level 3) to allow for high-speed traffic with up to 140 mph by 2005, making investments of GBP 2.5 billion necessary. In Oct. 2002, Network Rail replaced Railtrack. Underestimation of costs for reconstructing the tracks, failures in the management of the project and the fact that moving block technology did not develop to a mature technology, had led to a massive cost overrun at that time.

In 2003, the Strategic Rail Authority and Network Rail presented a new strategy, which included renewing the signalling and making it fit for ERTMS to be added later and reconstructing the tracks for a speed of 125 mph for tilting trains. This was done by Dec. 2008 at a cost of GBP 8.3 billion. The WCML got limited TEN-T funding of EUR 80 million. Over the past years the scope of works on WCML shifted several times, which seem to be a major reason of differing estimates and final costs.

Figure C5-5: Capacity use and capacity limitations of WCML in 2008



As Figure C5-5 shows the WCML even at completion is facing capacity problems again. Thus since 2009 discussions emerge to build a further high-speed line (so-called HS2) from London via Birmingham to Manchester and Leeds planned to be completed in 2026 to Birmingham and to Manchester and Leeds by 2032.

5.1 Methodology and remarks on CBA and project selection

For most of the first part of this section we refer to the WCML Feasibility Study from 1994 (Railtrack/ WCML-MDCL 1994), if not noted explicitly. The first thing to note is the objective concerning infrastructure quality, which was to recover the backlog of maintenance and repair over four years, without improving the infrastructure beyond a level of the properly maintained infrastructure e.g. by realignment of curves. The second issue to note is that the selection of the WCML project was not about deciding between different route options, but between different options of maintenance and upgrade to the WCML. In fact, the do-nothing option did not exist as due to lack of maintenance the WCML required a major upgrade and renewal just to keep the level of service to a level as it was originally planned for.

The selection of measures initially consisted of three options of infrastructure renewal and maintenance:

- **Bedrock:** A minimum investment strategy to maintain existing services, requiring a slightly higher level of renewals than at present.
- **Recovery:** Incremental investment, where cost-effective, to modernise the railway with conventional technology, gradually bringing it into a better state of repair.
- **Core investment programme (CIP):** Combining modernisation works, as in *Recovery*, with the introduction of radio transmission-based signalling and an integrated control centre. For the first 8 years of the construction programme the infrastructure capital cost of this option was estimated at GBP 960 million.

Given the later reports on the poor quality of the networks, these options are rather astonishing as with them even an increase of speed should be achieved, for which according to the feasibility study the new signalling technology and the power supply would be the most important issues, and not putting the track infrastructure into a shape to travel at speeds between 200 and 300 km/h, which were all discussed.

Comparing the three infrastructure options Bedrock was used as baseline against which the other two are compared. The CIP provided the best option generating a net present value that is GBP 190 million (1994 value) better than Bedrock from the point of view of the infrastructure provider and operator i.e. Railtrack. On top of this favourable option for keeping the level of infrastructure services further options were assessed that also involved contributions from potential train operators that e.g. would need to invest in faster (tilt) trains to implement these options. Five options have been considered (further options concerning freight are not listed below, but were discussed in the feasibility study):

- **Option A:** Improved track quality upgrading the track, above existing achieved standards, would improvement in ride quality, reliability and punctuality (max. speed 175 km/h).
- **Option B:** Increase in capacity to provide for enhancement of the power supply to allow an increase in passenger train frequency, which would be possible with the new train control system (max. speed 175 km/h).
- **Option C** (on top of option A): upgrade of tracks to 200 km/h linespeed for conventional trains.
- **Option D** (on top of option A): upgrade of tracks to 225 km/h linespeed for tilting trains.
- **Option E** (on top of option A): upgrade of tracks to 250 km/h linespeed for tilting trains.

Option A would cost additionally GBP 416 million, and options C to E would add between GBP 237 and 396 million on top of costs of CIP and Option A. It was anticipated that the whole modernisation programme could be completed by 2003-04 (Railtrack/ WCML-MDCL 1994, p.97) and that the CIP would provide the May 1994 timetable to be run more efficiently and with greater reliability than at present (p.90).

The study looked at cost and benefits from different angles, however falling short of what a socio-economic CBA today must include. Table C2-9 reveals that the appraisal considered at maximum the direct cost components of all involved actors (rail and road), plus time savings, reliability benefits and road accident savings. Impacts on non-transport users (e.g. residents along roads or rail lines) that benefit from changes in environmental impacts and their associated external cost (e.g. less noise, less air pollution) or improvements in greenhouse gas emissions are not appraised. Though for instance in the case of the freight rail options it is pointed out that residents could be affected by rail noise and noise protection measures might become necessary.

Table C5-17: appraisal criteria of feasibility study

Type of analysis	Level of appraisal	Impacts considered
Financial	Railtrack	<ul style="list-style-type: none"> • Infrastructure capital cost • Infrastructure fixed maintenance cost • Railtrack production cost
Financial	Rail industry as a whole	As above plus additional: <ul style="list-style-type: none"> • Rolling stock costs • Passenger revenues • Operators production costs
Financial and Economic	Rail industry and its users	As above plus additional: <ul style="list-style-type: none"> • Time savings of existing users • Reliability benefits to existing users
Financial and Economic	Rail industry, its users and the wider community	As above plus additional: <ul style="list-style-type: none"> • Time savings of highway users • Road vehicle operating cost savings • Road accident savings

Source: Railtrack/ WCML-MDCL 1994, p.85

Other aspects were discussed qualitatively. The feasibility study took into account the better development of municipalities along the lines, predicting, that major cities would benefit in terms of enhanced attractiveness of inward investments and employment generation through improved intercity service, while commuter towns would benefit from *"improved local service spreading economic activity and employment effects"*. In terms of employment, the study predicted positive effects and mentioned two points: construction works and operations of trains on the WCML, without quantifying the number of newly generated jobs.

The second appraisal considered the five main criteria requested by DfT: environmental impact, safety, economy, accessibility and integration. The summary of the appraisal is shown in Figure C5-6.

Figure C5-6: Appraisal of the Strategic Rail Authority in 2003

	Present values (£ million)	Per cent share
8 The Strategic Rail Authority's 2004 business case appraisal gave a 2.5:1 benefit:cost ratio for the enhancement element of the programme		
Costs		
Infrastructure costs	1,414	25
TOC passenger operating costs (including profit margin)	2,410	43
Freight operating costs	1,752	31
A: Total costs	5,576	100
Benefits		
Financial		
TOC passenger revenue	2,427	17
Freight revenue	1,231	9
Disruption costs	(25)	0
B: Total financial benefits	3,633	26
Non-financial		
Journey time benefits	6,222	45
Crowding benefits	733	5
Freight non-user benefits	1,829	13
Passenger non-user benefits:		
road decongestion benefits	1,293	9
accident benefits	224	2
Environmental benefits	(53)	0
C: Total non-financial benefits	10,248	74
D: Total benefits (B+C)	13,882	100
Summary		
E: Benefit:cost ratio (D/A)		2.5
F: Net financial benefits (B-A)	(1,943)	
G: Net present value (NPV) of benefits less costs (D-A)	8,306	
<i>Source: National Audit Office analysis of April 2004 West Coast Strategy Business Case Appraisal</i>		
NOTES		
1 The appraisal was based on an assessment period of 35 years (to 2038-39) at a discount rate of 3.5 per cent. We have converted all values to 2005-06 prices.		

Source: National Audit Office 2006

It seems to us that the engineering part of this initial feasibility study of 1994 was not sufficiently detailed and reliable as the poor status of the rail infrastructure was not known or not taken into account when estimating the cost for reliable and fast rail transport on the future WCML.

5.2 Methodology and remarks on environmental analysis

The feasibility study in 1994 contained an EIA according to laws required at that time. In general, it argued that impacts will be limited as the project is on renewing an existing infrastructure. By a map-based exercise potential conflict areas with cultural heritage and nature heritage were identified. External costs to non-user of the rail or road (modal-shift) have not been assessed. Noise impacts have only been assessed concerning the freight options but not the faster and more frequent passenger trains. Carbon dioxide or greenhouse gas impacts have not been estimated, as well (Railtrack/WCML MDCL 1994). As an example the summary of impact on nature is reported: *"Nineteen statutory sites for nature conservation about the boundaries of the WCML, and a further 22 sites are located within 500 m of the railway. Of the sites on adjoining land, 16 are sites of special scientific interest (SSSIs) designated by English Nature and Scottish Natural Heritage, and three are local nature reserves (LNRs) designated by local planning authorities under the provisions of the National Parks and Access to the Countryside Act 1949. One of these sites, namely the Upper Solway Flats and Marshes SSSI is also a 'Nature Conservation Review Site', and meets criteria for Ramsar/Special Protection Area designation under the provisions of the Ramsar Convention and the European Union (EU) Directive on the Conservation of Wild Birds, respectively. It is possible that this and other sites within the Study area will be designated as special areas for conservation (SAC) under the recently adopted Conservation (Natural Habitats etc.) Regulations 1994. Sites designated under these regulations will be afforded additional protection beyond the provisions of the Wildlife and Countryside Act 1981"* (Railtrack/WCML MDCL 1994, p.107). With this approach the EIA was rather carried out at the level of a scoping EIA.

The fully revised strategy for the WCML in 2003 was assessed based on five main criteria required by the Department for Transport (DfT) at that time. One of the criteria was environmental impact, including CO₂ emissions e.g. considering saved CO₂ due to modal-shift from road to rail (Strategic Rail Authority 2003). However, the environmental benefits account for less than 0.5% of benefits, compared with 45% contribution to benefits by time savings (journey time benefits).

The approach of 2003 already comes much closer to today's requirements of an EIA, though it still neglects the life-cycle impacts of infrastructure and vehicles (upstream and downstream). Further, today also indicators of energy use would be part of an EIA, looking at both total change of energy demand for transport by a project and reduction of fossil energy demand.

5.3 Characteristic of the transport demand scenario and its economic drivers

Transport demand scenarios in the feasibility study of 1994 were based on common GDP growth assumptions using a high, central and low growth scenario and applying this to network models for both road and rail that cover whole Britain mainland with a number of 186 zones. Sensitivity analyses concerning elasticities were carried out both on and off the models. This approach seemed to be state-of-the-art of transport modelling of the 1990`s.

In the case of the WCML the transport demand scenario was not the cause of the observed cost overruns (see section 5.5). In other words, there was no optimism bias expecting a higher demand than actually would occur on the implemented infrastructure. Just the opposite was the case: demand forecast for both passenger and freight transport were well below the actual demand trends. The reasons for this could be speculated: until the mid of

1990's rail lost modal share and ridership in the UK. The applied models usually would be calibrated to reflect such a framework and they will never be able to model a turning point or a trend-break that obviously was achieved by the renewal of WCML after about 2005, when year-on-year growth rates of passenger rail transport reached levels of 20%.

5.4 Investment cost and structure of financing

Both the investment plan in 1994 and in 2003 looked at the whole line and identified track sections and other infrastructure elements (i.e. signalling, power supply) that required renewal and/or upgrade to fulfil the objectives defined for the WCML (e.g. linespeed, train capacity, punctuality targets). The cost for the sections and other infrastructure were added-up to estimate the full cost of the WCRM programme. The two crucial issues that caused the largest impact on increase of investment cost above plans were (1) that the chosen control technology was not mature, which was then deleted from the 2003 update together with an obsolete control centre, and (2) that the state of quality and maintenance of the infrastructure (in particular network infrastructure) was virtually unknown. Thus a very first step of the 2003 renewed WCML strategy was to systematically check, categorize and file the asset status of the whole WCML in a comprehensive database. This formed the detailed base for further asset management and investment plans. Additionally these maintenance plans were converted from a short-term "repair-worst-sections-only" approach to a long-term planned life-cycle approach.

The plans for upgrade of WCML in 1994 foresaw funding by the private operators. Railtrack should have been able to fund the infrastructure investments from the track access charges, and the service operators would fund their investments from increased demand. The revised plan in 2003 involved full funding from the national budget apart from 80 m€ that were provided from TEN-T funding (1,4%, TENtec Information System 2009).

A very relevant difference between the two studies concerned the discount rate for future costs and benefits. In the feasibility study of 1994 the rate was 8%. The Strategic Rail Authority applied a rate of 3.5%. This should be one of the reasons why the longer term impacts of underinvestment in maintenance was not appropriately taken into account.

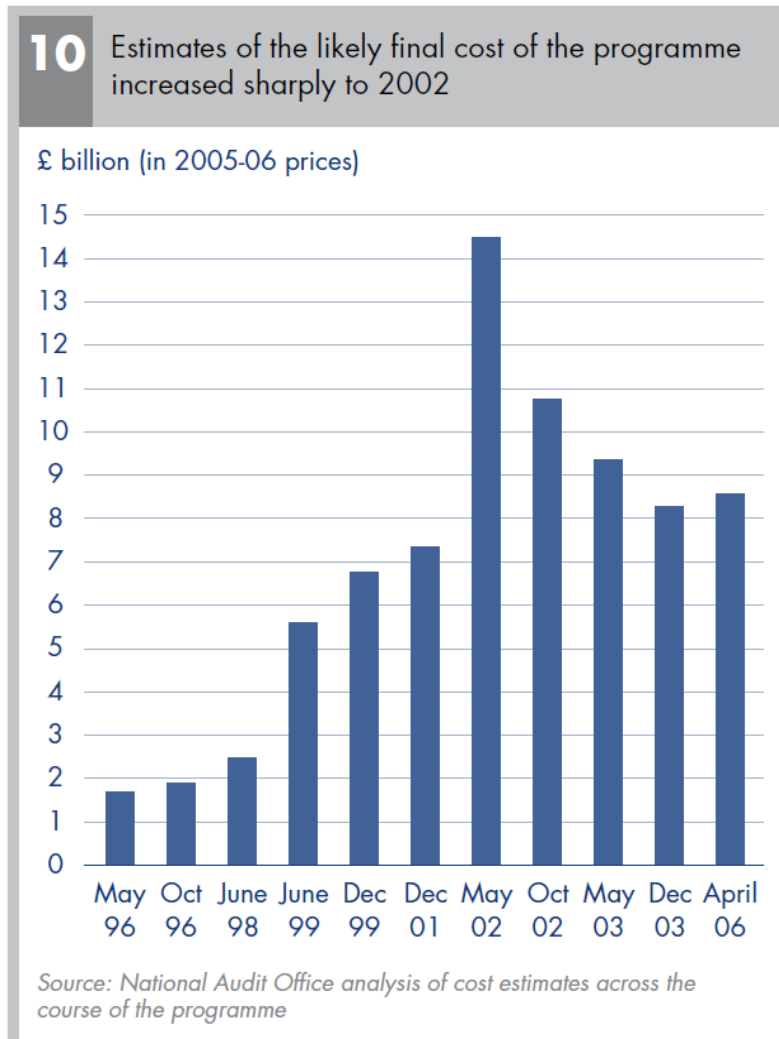
The cost overrun of the plans from 1994 happened despite a risk analysis was carried out, which led to the conclusion that the worst case for the CIP scenario would be an overrun of 10% (Railtrack/WCML MDCL 1994, p.72). This reveals that also risk analysis has to be treated with great care, as the total cost overrun, of course not only of the CIP, amounted to a sevenfold increase.

5.5 Cost developments over the life-cycle of the project

The cost estimates over the course of the renewal of the West Coast Main Line (WCML) changed drastically. Over six years starting from the initial cost estimate in 1996 a sevenfold increase was observed by the National Audit Office (2006) undertaking an ex-post analysis (see Figure C5-7). However, one should have in mind that until 2002 and before the Strategic Rail Authority and Network Rail took over the responsibility for the West Coast Route Modernisation (WCRM) programme the project was suffering from a moving target due to imprecise specification. This means a large part of the growing cost were due to re-design and more detailed design of the investment plans over time. Unlike as in other projects it was not the influence of considering environmental constraints (e.g. for noise barriers, tunnels or deviations to circumnavigate ecological sites) that drove the cost increase.

Figure C5-7 also indicates that after Strategic Rail Authority (later Department for Transport) took the responsibility for directing the project Network Rail took over the implementation of WCRM in 2003 they further reduced the cost of the programme due to better specification and use of existing cost-saving measures the cost estimate remained rather stable between GBP 8.2 and 8.6 billion (in 2005/06 prices). In 2009 Network Rail reported that for the completion of WCRM GBP 8.8 billion were spent, which is reasonable close to original plans (Network Rail 2009).

Figure C5-7: Cost estimates over time



NOTES

- 1 These expected costs relate to different scopes/expected outputs.
- 2 May 1996 – Core Investment Programme (CIP); October 1996 – CIP+PUG 1; June 1998 – CIP+PUG 2; June 1999 – Baseline 1; December 1999 – Baseline 2; December 2001 – Revised Baseline 2; May 2002 – Baseline 3; October 2002 – Upper limit accepted by government for WCML Strategy; May 2003 – Baseline 5; December 2003 – Implied by Rail Regulator's funding conclusions; April 2006 – Spend to date and Network Rail Business Plan forecast spend.
- 3 The estimates unadjusted to 2005-06 prices (i.e. for the price bases used at the time) were: May 1996 – £1.3bn; October 1996 – £1.5bn; June 1998 – £2.1bn; June 1999 – £4.8bn; December 1999 – £5.8bn; December 2001 – £6.3bn; May 2002 – £13.2bn; October 2002 (upper limit) – £9.9bn; May 2003 – £8.8bn; December 2003 – £7.6bn; and April 2006 – £8.1bn (see footnote 7).

Source: National Audit Office 2006

Revenues from service operators were considered in the plans, both in 1994 and in 2003. However, underestimation of growth of transport demand should have led to even higher revenues than estimated ex-ante. Network Rail regularly sets-up business plans, including plans for major routes like the WCML, and provides reviews of their plans in their Annual Delivery Plan Updates. These reviews also provide cost and revenue forecasts for the next five years (see e.g. Network Rail 2010b)

In terms of how the WCML is actually performing against the 2003 business case, no formal post project review has been undertaken, yet, and will be undertaken until after the next franchise implementation, expected in 2014, six years after implementation in full. This is partly because volumes and revenues are integral parts of the highly confidential franchise bidding process and partly to allow the initial period of rapid growth to stabilise. However, it is clear that the volumes of customers significantly exceed those anticipated in the 2003 appraisal work of the then Strategic Rail Authority. Additional trains were drafted into passenger service on the line in 2008 and the Department for Transport has recently, in partnership with the industry, provided further new trains and lengthened many of the existing trains from 9 to 11 cars with 264m length, the maximum practicable on the route. Similarly, freight traffic is growing fast and the Department for Transport has recently announced significant investment in upgrading key links from the ports to the WCML which will facilitate still further growth in freight traffic.

5.6 Lessons learned from the period 1996-2002 of WCML renewal

During 2002-2003 intense debate about failures and needs for redesigning the WCRM programme were carried out, which managed to bring down the cost estimate from about GBP 14 billion to about GBP 8 billion. The rail industry and the UK transport authorities draw some important lessons learned from this joint exercise for the assessment of such mega-projects (Strategic Rail Authority 2003, p.57):

- A Project's objective needs to be set in a clear, all industry and stakeholders context.
- The scope of a Project needs to be carefully controlled with a clear Sponsor.
- An accurate assessment of the renewals can only be achieved with a clarity of knowledge about the asset condition and clear projections of future use.
- Project Programmes need to be realistic and accurately baselined, with costs and timescales clear.
- Project interdependencies need to be fully assessed on an overall 'system' basis (e.g. adequate power for enhanced outputs).
- Projects on a working railway must include the means of delivery as a critical element of the confirmation process of a design specification.
- Clear Programme and Contractor management arrangements are essential in large projects. Outputs require to be clearly defined and managed against costs and programme in a rigorous manner.

The case of the WCML renewal and the Hatfield accident in 2000 also influenced the Government strategy for railways. DfT formulated their lessons learned as follows (DfT 2004, p.16):

- Firstly, maintaining a Victorian railway and adapting it to modern needs requires sustained investment, which the railway has not received.

- Secondly, delivering a successful railway requires a balance between engineering, operational and financial priorities.
- Thirdly, the relationships between and within the public and private sectors must be properly structured so that the industry's primary funder, the Government, specifies clearly the outputs it is buying, rather than relying on a distorted commercial market.
- Fourth, there needs to be a clear understanding of what rail does best and of its place in a coherent and balanced wider transport strategy.
- Fifth, under the structure of the UK rail industry in 2004, none of these was the case.

5.7 References

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ANNEX 6: FEHMARN BELT FIXED LINK

Table C6-18: Project summary Fehmarn Belt Fixed Link

Aspect	Description	Aspect	Description
Project Title	Fehmarn Belt Fixed Link (planning and preparatory works)	TEN-T code	2007-EU-20050-P
Countries / area	Denmark, Germany	Start date	June 2008
Mode(s)	Rail, road	End date	December 2015
Managing authority	Femern A/S	Duration	90 months
		Delay (months)	-
Investment cost (m€)	<p>Coast-to-coast fixed link: 1999 estimate (1996 prices) Cable-stayed bridge: 3,040 Immersed tunnel (4+2 solution): 3,780</p> <p>2011 estimate (2008 prices): Immersed tunnel (4+2 solution): 5,500 Construction costs: 3,800 Other works: 300 Project management, operational preparations: 700 Reserves: 700</p> <p>Present (preparatory) phase: 486</p>	Length (km)	17.6 km
EC funding TEN-T (m€)	Present (preparatory) phase: 339 reduced to 267 Until end 2008: 19.7 2009: 10.32 2010 (estimated): 50.80 2011 (foreseen): 22.70 2012-2013: €30.17 2014-2020: €6,500 Source: TEN-T EA (2012)	EC share	Studies: 50% Works: 23.89%
EC funding Cohes. (m€)	d.n.a.	EC share	d.n.a.
Funding agent 1	Femern A/S (state owned), from private market and Danish National Bank	Value (m€)	to be determined
Funding agent 2		Value (m€)	-

Cost-benefit-analysis	<p>(1) PLANCO/COWI (1999): Economic and financial evaluation of a fixed link across the Fehmarn Belt, Final Report, June 1999:</p> <p>Value of time: ECU 9.0/36.5 per hour of leisure/business trip (year not specified)</p> <p>CO2 value: DEM 180 per tonne (year not specified)</p> <p>Social Discount Rate : 3%</p> <p>(2) Danish Ministry of Transport & COWI (2004): Economic Assessment of a Fixed Link across the Fehmarn Belt. Summary Report. June 2004.</p>	CBA ratio	<p>EBC Ratio: BCR between 0.84 (bored railway tunnel) and 2.6 (immersed tunnel); EIRR : between 2.2 and 7.8 % respectively</p> <p>(2) (immersed tunnel)</p> <p>EBC Ratio: ?</p> <p>EIRR : 6.9%</p> <p>NPV: 1.9</p>
Transport scenario	<p>(1) FTC (Fehmarn Belt Traffic Consortium) (1999): Fehmarn Belt Traffic Demand Study, Final Report</p> <p>(2) Update: FTC (2003): Fehmarn Belt Forecast 2002, Final Report, April 2003</p>	Public y/n	Y
Externalities covered	<ul style="list-style-type: none"> • Emissions of poisonous exhaust gases • Climate relevant emissions of CO2 • Traffic noise • Separation effects of road traffic in build-up areas • Other impairments from road traffic in build-up areas 	Dated from	<p>(1) June 1999</p> <p>(2) April 2003</p>
EIA	In progress see Scoping Report: Proposal for environmental investigation programme for the fixed link across Fehmarn Belt)	Ext. cost (m€)	Solution Model 1 (Scenario 0+2): 21.4 m€ (2010)
CIA	No separate CIA: Climate change avoidance costs integrated in CBA	Public y/n	-
Financial analysis	<p>(1) PLANCO/COWI (1999): Economic and financial evaluation of a fixed link across the Fehmarn Belt, Final Report, June 1999:</p> <p>(2) Femern A/S (2008): Financial Analysis</p> <p>(3) Femern Sund & Baelt (2011): Consolidated construction estimate for the Fehmarnbelt Fixed Link – August 2011.</p>	Public y/n	-
Ex-post evaluation	d.n.a.	Expected RoI	<p>(1) FIRR between 1.7 % (2-track immersed rail tunnel) and 9.1 % (immersed 2-lane road and 1-track rail tunnel)</p> <p>(2) Payback time for the emerged tunnel is about 33 years.</p> <p>(3) Payback time: 39 years</p>
		Cost overrun (m€)	-

Source: own analysis

Figure C6-8: Fehmarn Belt Fixed Link

"The Fehmarn Belt Fixed Link project is part of the global project Fehmarn Belt railway axis (Priority Project 20). As an extension of the Øresund crossing (Priority Project 11) and the Nordic triangle road and rail links (Priority Project 12), it is a key component in the main north-south route connecting the Nordic countries to the rest of Europe.

The project covers three activities:

1. the Approval phase – studies
2. the development phase – studies
3. the construction phase – works

Source: TEN-T EA

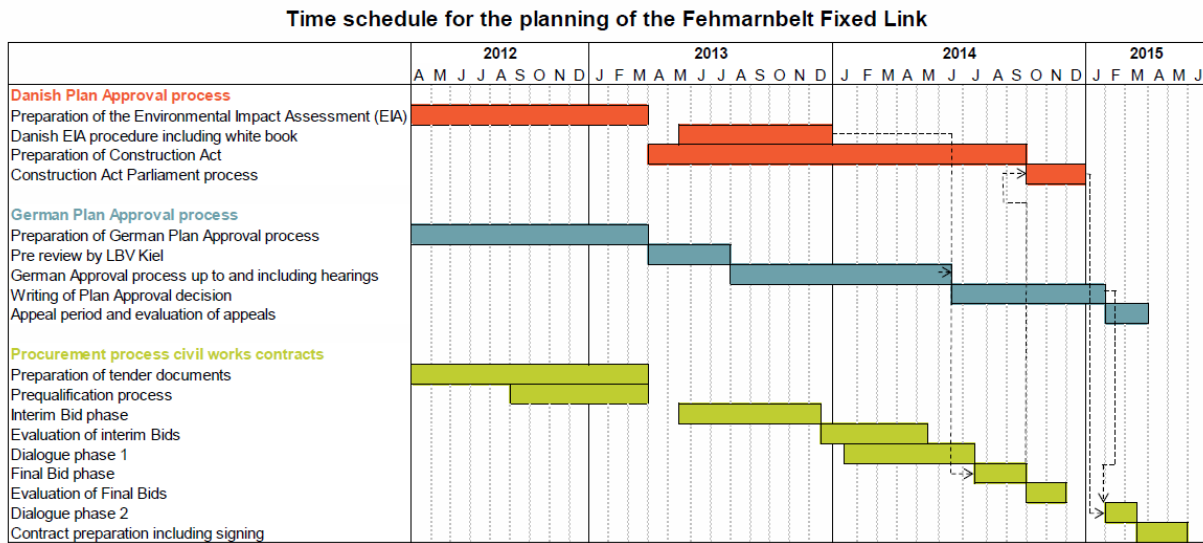
The studies cover environmental, geotechnical and navigational investigations, safety assessments as well as design activities and adaptations for use in the plan approval process of the authorities. The geotechnical investigations are confined to the planned link corridor, whereas the environmental investigation will cover wider areas of the entire Fehmarn Belt and most of Kieler Bucht and Mecklenburger Bucht. The studies also constitute the basis for identifying the best technical solution (bridge or tunnel).

The construction activities will primarily be the establishment of the prefabrication areas for the production of tunnel elements or bridge caissons, piers and girders."

Activities in the present TEN-T budget cycle are preparatory studies and works for the construction of the coast-to-coast fixed link scheduled for 2015 to 2021. Besides, the planning processes are underway for rail access in Germany (2007-DE-20010-S: Studies for connecting the German hinterland to the future Fehmarn Belt fixed link, rail section Lübeck-Puttgarden; EUR 25.4 million - EU contribution: 50%) and in Denmark (2007-DK-20060-S: Studies for the capacity improvements of the section between Copenhagen and Ringsted; as well as 2007-DK-20070-S: Studies for upgrading the railway access lines to the future Fehmarn Belt fixed link - from Ringsted to Rødby and the intersection in Kastrup; both together EUR 45.4 million - EU contribution:50%).

The most recent schedule (April 2012) of the preconstruction preparatory activities is shown in the table below.

Figure C6-9: Planned time schedule for the Fehmarn Belt Fixed Link project



Expected opening: End of 2021.

Source: Femern A/S

6.1 Methodology and remarks on CBA and project selection

In 1999, in context of preliminary studies concerning the fixed link across the Fehmarn Belt, an economic analysis has been carried out. The analysis was done by consultants of the German and Danish Ministries of Transport³², based on the methodology of the German BVWP methodology with adaptations to Danish methodological recommendations. At the time, no officially recommended methodology for the evaluation of EU supported projects existed. The CBA can be considered as “state-of-the-art” at the time.

In 2003, a new CBA has been requested by the Danish Ministry of Transport in accordance with Danish requirements.³³

Regarding the Economic Analysis which has been carried out for the Fehmarn Belt Fixed Link in 2004 the following elements were considered:

- *Investment costs:* For the fixed link and for the necessary railway investments on land.
- *Operating costs of the fixed link*
- *User benefits:* Time savings and changes in vehicle operating costs distributed on benefits for existing users as well as new and transferred users.
- *Environmental costs:* Including air pollution, noise and accidents, and CO2-Emissions.
- *Revenue from the fixed link.*
- *Consequences for other operators:* Including railway track managers, railway operators, the Great Belt and the Øresund fixed links.

³² PLANCO/COWI (1999): Economic and Financial Evaluation of a Fixed Link Across Fehmarn Belt, Final Report, June 1999.

³³ Danish Ministry of Transport (2004): Economic Assessment of a Fixed Link across the Fehmarn Belt. Summary report, p. 8.

The above elements are traditionally the key elements in analyses of transport investments, and they are considered decisive as to whether a fixed link is economically profitable. Besides the above elements, a fixed link may also have other effects such as reduced barrier effect, loss of undisturbed nature, and inconvenience during construction etc. These effects are not included as it has not been possible to quantify them. No further CBA has been ordered by the Danish government.

Throughout the complex process of planning, the Fehmarn Belt project had always the political endorsement by the Danish government and the Danish parliament.

As far as we could establish, no specific selection procedure took place at national level. The project was proposed by the Danish government and negotiated with the German government. As Germany was reluctant to invest in the fixed link, Denmark decided to implement the coast-to-coast infrastructure alone while Germany agreed to upgrade and electrify the railway line Luebeck-Puttgarden.

When the TEN-T programme for 2007-2013 was negotiated, the Danish and German governments requested the Fehmarn Belt project to be added to the list of priority TEN-T projects. Both governments of Germany and Denmark considered the project to have a common interest goal. The project was retained on the basis of the different studies and assessments which had been carried out. The Danish government always had the Fehmarn Belt Fixed Link project on its priority list.

This choice can be supported by four arguments which represent the common interests of the EU.

- **EU Transport Policy**

One reason for putting the Fehmarn Fixed Link on the TEN-T Priority list has to do with the goals of the European Transport Policy. One of these goals is to transform the existing patchwork of European transport infrastructure into a unified, high-quality Trans-European Transport Network (TEN-T) that can handle the expected continuous increase in traffic volumes; connecting the peripheral regions to the central areas, removing bottlenecks, upgrading infrastructure and improving cross-border transportation for passengers as well as for goods.³⁴

Integration of the European RegionsAs second reason for prioritizing the Fehmarn Belt Fixed Link forms the EU funding. The Fehmarn Belt Fixed Link is an integral part of the EU's priority transport project no. 20 "Fehmarn Belt Railway Axis" and also of the EU's priority core network corridor 5 - a North-South corridor that runs all the way from Helsinki in Finland to Valletta in Malta. Once completed, the corridor will contribute to the political goal of further integrating Europe's regions: as travel and transport times diminish and transnational interaction increases, disparities between regions are expected to decrease.³⁵

- **EU Internal Market**

Furthermore contributes the project the European objectives of strengthening the competitiveness of the Internal Market and of increasing integration between Member States and regions. By reducing the travelling time in the Danish-German cross-border region, the fixed link also enables the emergence of new mobility and logistics patterns. Passengers travelling between Copenhagen and Hamburg will save at least one hour, freight trains about two hours and 160 km compared to the present route via Jutland/Great

³⁴ <http://www.femern.com/home/region-3/the-european-dimension/eu-transport-policy> (14.11.2012)

³⁵ <http://www.femern.com/home/region-3/the-european-dimension/eu-funding> (14.11.2012)

Belt. This facilitates an increased exchange across the belt between continental Europe and Scandinavia, thus strengthening the competitiveness of the Internal Market.³⁶

- **EU Climate Change objective**

In addition the positive impact on climate change is also an important factor in the selection of the Fixed Link as a priority project. The Fixed Link across Fehmarn Belt is, first and foremost, part of a trans-European goods train corridor and will strengthen the relative competitiveness of CO₂-efficient freight trains. Both the reduction of ferry emissions and the shortening of the route between Scandinavia and continental Europe by 160 km for freight trains will directly result in reduced energy consumption and thus in lower emissions of pollutants and GHG.. The Fehmarn Belt fixed link thus directly contributes to the EU climate change objective to reduce transport-related greenhouse emissions by 60% until 2050.³⁷

The Fehmarn Belt fixed link with access rail and road routes has been retained as part of the core network for financing during the 2014 to 2020 cycle.

6.2 Methodology and remarks on environmental analysis

The activities concerning environmental conditions and impacts along the Fehmarn Belt route have been multiple over the years. From 2009 till 2011 various field studies (in the whole region of the Fehmarn Belt Fixed Link) have been carried out. The EIA forms a part of the application for approval of the project. An EIA study according to EU regulations is underway and close to finalisation. The plan is to hand it over to the Danish and German authorities in summer 2013.

The EIA involves identification, description and assessment of the project's impact on the factors human beings (including human health), fauna and flora (including biodiversity), soil, water, air, climate, landscape, cultural heritage and other material assets as well as the interaction between these environmental factors.

The project applicants must present information on the project's environmental impact which is essential to the decision making regarding the tunnel, the "Environmental Impact Statement" (EIS), to the competent authorities in Denmark and Germany. In the EIS all effects due to construction, presence of physical structures and operation of the fixed link on the above environmental factors will be identified, described and assessed. The Danish Minister of Transport has assigned Femern A/S the responsibility to conduct the EIA and draw up the EIS for the Fehmarn Belt Fixed Link.³⁸

The substance and extent of the proposed environmental investigations fulfil Danish and German legal requirements and standards. International norms and standards for environmental investigations like HELCOM (Helsinki Commission)³⁹ recommendations are also taken into consideration. If relevant, The "Baltic Sea Pressure Index" (list of environmental pressures) will be included in the investigations, if HELCOM has finished the development of this before the EIA is concluded

³⁶ <http://www.femern.com/home/region-3/the-european-dimension/eu-internal-market> (14.11.2012).

³⁷ <http://www.femern.com/home/region-3/the-european-dimension/eu-climate-change-objective> (14.11.2012).

³⁸ Femern A/S and Landesbetrieb Strassenbau und Verkehr Schleswig-Holstein. (2010): EIA Scoping report, Proposal for environmental investigation programme for the fixed link across Fehmarn Belt (coast-coast), p. 2.

³⁹ HELCOM : One of the most important duties of the Helsinki Commission is to make Recommendations on measures to address certain pollution sources or areas of concern. These Recommendations are to be implemented by the Contracting Parties through their national legislation. Since the beginning of the 1980s HELCOM has adopted some 200 HELCOM Recommendations for the protection of the Baltic Sea. Online: http://www.helcom.fi/Recommendations/en_GB/front/ (19.11.2012).

The following environmental factors are analysed in detail with respect to those potential environmental impacts which are relevant for the EIA of the Fehmarn Belt Fixed Link:

- Human beings, incl. human health, flora, fauna and biological diversity
- Soil, water, air, climate and landscape
- Cultural heritage and other material assets
- Pertinent interactions among the afore-mentioned environmental factors.⁴⁰

The EIA consists of two steps which are subdivided in different sub-categories. As a first step a spatial sensitivity analysis has been carried out to identify "relatively low impact corridors" for possible routes within a study area extending to the east and west of Puttgarden. The entire potential on- and offshore project area of the fixed link has been examined. On land, the area extends both west and east of the ferry ports of Puttgarden and Rødbyhavn. The spatial sensitivity analysis (*Raumempfindlichkeitsanalyse*) will analyse the importance and sensitivity of the environmental factors in relation to the project largely based on information already available.

As a second step the technical planners developed the various general alignment alternatives for the bridge and tunnel solutions. Alternatives include alignments with landing sites west of Puttgarden and Rødbyhavn (west-west), landing sites east of Puttgarden and Rødbyhavn (east-east) as well as alignments diagonally from east to west etc. These route alternatives are then assessed and optimised with respect to environmental standards, but also with regard to aspects of traffic, navigation safety, economy as well as other factors. A comparison of the alignment alternatives with respect to environmental impacts on the environmental factors and components will form the basis for a prioritisation of the alternatives, and lead to a selection of the alignment alternative with the least environmental impact for both the tunnel and the bridge solution.

All the relevant environmental investigations in line with European regulations are included in the Environmental Impact Assessment which will be finalised mid-2013.

6.3 Characteristic of the transport demand scenario and its economic drivers

The traffic forecast studies were carried out by a mixed Danish and German consortium of transport consultants (selected by a public tender procedure) using state of the art traffic modelling methodologies.

The estimated revenue from the coast-to-coast link has been calculated on the basis of the traffic forecasts prepared by the FTC (Fehmarn Belt Traffic Consortium). The traffic forecast was prepared on the basis of an opening of the fixed link across the Fehmarn Belt in 2015. During the period of 2015-2018 the underlying assumptions result in an annual growth of 1.7% in road traffic. This analysis assumes that a conservative zero growth in traffic after 25 operations years (2015-2040).⁴¹

Since 2001, a drastic growth on the ferry crossing of Rødby-Puttgarden has been seen in road traffic. During the period from 2001 to 2007, the average traffic growth on the ferry crossing was 5.4% per year. The actual traffic in 2007 was almost 6,250 vehicles per year.

⁴⁰ Ibidem.

⁴¹ Femern A/S for the Danish Ministry of Transport (2008): Financial Analysis. Fixed Link across Fehmarn Belt, p. 10.

This equals the forecasted traffic volume in 2013. In 2007, road traffic between Rødby and Puttgarden was thus approximately 6 years ahead of the traffic forecast.⁴²

In the following table the traffic forecast for the road traffic across the Fehmarn Belt Fixed Link in 2018 (with and without ramp-up) is shown.

Figure C6-10: Traffic forecast for road traffic across the Fehmarn Belt Fixed Link in 2018

Number of vehicles per day	Traffic forecast	Traffic forecast, including ramp-up
Passenger cars	8,200	6,600
Lorries	1,300	1,000
Buses	100	100
Total	9,600	7,700

The numbers are rounded off to nearest hundred

Source: Femern A/S for The Danish Ministry of Transport (2008): Financial Analysis. Fixed Link across Fehmarn Belt, pp. 10-11.

Furthermore it is expected that the traffic will grow by 1.7% per year till 2025. After that the traffic demand will remain constant.⁴³

The main governing assumptions are not being explained within the Financial Analysis report of 2008.

Since the 2003 fixed link traffic forecast, there has been an update of the traffic forecasts within the Financial Analysis of 2008 which has been carried out for the Fehmarn Belt project. Both the 1999 and 2003 forecasts assume that the economic will grow with intensifying international (intra-EU) trade.

6.4 Investment cost and structure of financing

The Fehmarn Belt Fixed Link has been declared a priority project as part of the 2007-2013 planning of the expansion of the trans-European transport network of the European Union (TEN-T).

It makes an important contribution to completing the central North-South axis between Scandinavia and central Europe along the shortest route. As a result, the project has received substantial funding from the European Commission as part of the programme for a trans-European transport network. The Commission granted funds amounting to initially to EUR 339 million, now to EUR 267 million for the time period 2007–2013. This corresponds to roughly 34% of the costs estimated until 2013.

As part of the mid-term review in 2010, all of the projects with grants from the EU were evaluated by independent consultants to the Commission. Based on this review, the subsidies were reduced by around EUR 72 million from EUR 339 million to EUR 267 million for the time period 2007–2013 because of reduced spending. In a Second Amending Decision of 23 January 2012 the budget for 2007-2013 was further revised to

⁴² ibidem, p. 12.

⁴³ Femern Bælt A/S for the Danish Ministry of Transport (2008): Financial Analysis. Fixed Link across Fehmarn Belt, pp. 10-11

EUR 193 million. It is, however, assumed that these funds will be shifted to the next funding period.

EU subsidies will again be applied for the time period 2014–2020. According to Femern A/S, the present financial assessment of the project is based on a minimum TEN-T grant of 10% of the construction costs.

The final engineering of project funding has not yet been firmly decided by the Danish government. It is anticipated that subject to confirmation, by the Danish government, Femern ASA will be the implementing agency of the fixed link project. In this case Femern will also be in charge of project funding.

Construction funds will be raised in private capital markets. The Danish State will guarantee loans and bonds. The Danish National Bank will be on stand-by to complement private funding if insufficient.

In the longer term, revenues from the usage of the fixed link are expected to pay back all debts.

The way the project has been analysed by the Danish government does not refer to the return of investment (RoI), but to the total payback time which also takes account of the risks of the project. According to the latest financial assessment, the payback period is 33 years.

6.5 Cost developments over the life-cycle of the project

Till 2010 it was expected that the cable-stayed bridge was the most suitable solution for a fixed link, based on the assessment of eight alternative cases (cable-stayed bridge, suspension bridge, bored tunnel, immersed tunnel, with different capacity level for road and rail traffic). New studies showed that an immersed tunnel would be a better alternative. In 2011, an immersed tunnel with 4 road lanes and 2 rail tracks was recommended to the Danish parliament as the preferred solution, with a cable-stayed bridge as a second-best preferred solution. A final decision has not yet been made.

Since the first financial evaluation, in 1999, of the various project solutions, costs of selected solutions were updated from time to time. In the course of time, the ranking has changed.

The costs of the presently preferred solution, i.e. the immersed tunnel with four road lanes and double (electrified) rail tracks (4+2) are estimated to amount to a total of EUR 5.5 billion, with construction costs of EUR 4.1 billion (2008 price level). Back in 1999, cost estimates for the different solutions (1996 price level) ranged between EUR 2.9 billion (immersed 3+1 tunnel) and EUR 4.4 billion (bored tunnel 4+2), with the immersed 4+2 tunnel estimated at EUR 3.8 billion.

According to Femern AS, the drivers for the cost increase by roughly 45 percent were:

- The cost estimate in the FS (stated in 2008 prices) is EUR 5.1 billion, the current cost estimate is EUR 5.5 billion, the difference is EUR 0.4 billion. As the FS was reported in 1996 prices, inflation accounts for an increase of EUR 1.3 billion or 35 %. The remaining (real) difference is as follows:
- A number of changes have been introduced in the conceptual design of the IMT, that forms the basis for the plan approval procedures in German and Denmark. The

solution presented in the FS has been developed and optimized on basis of current legal requirements, including the Tunnel Safety Directive, the TSI's (Railway) and environmental legislation such as the EIA-directive, Natura-2000 directives. The net impact on cost is only to a minor change in the cost estimate. An example of change in the project; the motorway now has full emergency lanes in both directions.

- The major change in the cost estimate to the FS is related to the planning phase, especially the project approval by the authorities in the two countries. In the FS 3 years was allowed for planning, now it can be concluded that the planning phase will be at least 6 years. The increase in time and cost is related to investigations of alternative solutions, where now in all 4 technical solutions (conceptual designs) have been developed, environmental impacts assessed etc. This is due to the implementation of German Natura protection law and due implementation of the requirements based on EU directives in the two countries and requirements of the Natura 2000 directive.

Annual operations and maintenance costs are estimated to be around EUR 73.7 million (2008 prices), compared to EUR 68.2 million in the original cost estimate (1996 prices). We are not in a position to judge whether or not these costs were properly assessed.

As regards the assessment of revenues, the rather unstable economic situation in most of Europe certainly affects the reliability of revenue estimates. This risk is, however, borne by the Danish government under the State guarantee model by which the State guarantees all equity and loans of the implementing body.

Appendix 1: Chronology

1991: At the signing of the treaty on a fixed link of the Öresund between Denmark and Sweden in 1991, Denmark agreed to a fixed link across the Fehmarn Belt for road and rail transport between Germany and Denmark. The aim is to improve the transport of persons and goods in an environmentally responsible and sustainable manner by shortening the route via the Great Belt and replacing the existing Fehmarn Belt rail ferry services.

1999: completion of technical, environmental and economic studies (see list of sources). The project consists of the coast-to-coast fixed link and the rail and road access lines on both sides including electrification. Various alternative technical solutions were investigated including cable-stayed or suspended bridge types and immersed or bored tunnel types at various levels of capacity (2 – 4 road lanes; 1-2 rail tracks).

2000: Danish-German memorandum to build the Fehmarn Belt fixed link

2001/2002: Enquiry of commercial interest in the implementation of a PPP project: the result of the enquiry was inconclusive since both governments did not want to commit themselves on a specific risk sharing concept.

2005: The Fehmarn Belt fixed link is listed as the main element of the TEN-T Priority Project n° 20. With the Öresund fixed link between Sweden and Denmark, opened in July 2000, the Fehmarn Belt fixed link would complete the direct land corridor between Scandinavia and Central Europe.

2007: The Danish and German Ministers for Transport signed a declaration of intent on establishing a fixed link across the Fehmarn Belt.

2008/2009: State treaty for the establishment of a fixed link across the Fehmarn Belt, ratified by the Danish parliament on 26 March 2009 to coincide with the enactment of the Danish Planning Act and by the German parliament on 18 June 2009.

2010: The State of Schleswig-Holstein launched in May 2010 a regional planning process (ROV) for the rail hinterland connections. Furthermore the effects on human health, soil, water, air, climate, landscape, animals, plants and ecosystems, which in their turn have an impact on tourism and-municipal developments resulting from route closures or common developments have been investigated.

2011: The Danish Minister for Transport declared immersed tunnel solution as the preferred crossing. A preferred alternative variant is the bridge solution. Rødbyhavn was fixed as the only production site for the tunnel on grounds of the EU Directive 85/337/EEC ("the EIA Directive"). As a consequence environmental impact assessments (EIA) had to be conducted for this part.

The Budget Committee of the Danish Parliament approved the increase the budget for the planning exercise. This allowed Femern A/S to prepare the building of civil engineering construction work and start planning for a security system for vessel-traffic during construction.

In August 2011, Femern A/S published a consolidated management accounting. Thereafter the cost for the immersed tunnel was estimated to EUR 5.5 billion and the Danish hinterland connections to approximately EUR 1.1 billion (2008 prices). The amortization period is estimated at 39 years.

2012: Consolidated technical report in which the main characteristics of possible variants immersed tunnel crossing, cable-stayed bridge, suspension bridge and bored tunnel are discussed.

Appendix 2: Sources

Year	Type	Title
2012	Schedule	Femern A/S (2012a): Time schedule for the Fehmarnbelt coast-to-coast project, April 2012
2012	General	Femern A/S (2012b): Annual report 2011, April 2012
2011	General	Femern A/S (2011a): Annual report 2010, March 2011
2011	Costs	Femern A/S (2011g): Consolidated construction estimate for the Fehmarnbelt Fixed Link, August 2011
2011	Technical	Femern A/S (2011h): Consolidated Technical Report, Draft, December 2011
2011	Technical	Femern A/S (2011c): Facts & Figures – The immersed tunnel, May 2011
2011	Technical	Femern A/S (2011d): Facts & Figures – The cable-stayed bridge, May 2011
2011	Environmental	Femern A/S (2011e): Fact & Figures – Environmental Investigations, May 2011
2011	Administrative	Femern A/S (2011f): Fact & Figures – The approval process, May 2011
2010	General	Femern A/S (2010c): Planning status – Fehmarnbelt coast-to-coast, November 2010
2010	Environmental	Femern A/S, Landesbetrieb Strassenbau und Verkehr Schleswig Holstein (2010): Proposal for environmental investigation programme for the fixed link across Fehmarnbelt (coast-coast), EIA Scoping Report, June 2010
2010	General	Femern A/S (2010a): Annual Report 2009, April 2010
2010	Technical, environmental	Femern A/S (2010b): The preferred technical solution for the EIA process – the recommendation of Femern A/S + 8 appendices, November 2010
2009	Planning Act	Act on Project Planning for a Fixed Link over the Fehmarn Belt, with Associated Land Facilities in Denmark, 15 April 2009
2008	Treaty	Treaty of 3 September 2008 between the Kingdom of Denmark and the Federal Republic of Germany on a fixed link across the Fehmarnbelt
2008	Financial	Femern A/S (2008): Fixed Link across Fehmarnbelt Financial analysis, September 2008
2007	Memorandum of Understanding	Memorandum of Understanding regarding a treaty on a fixed link across the Fehmarnbelt between the Federal Republic of Germany and the Kingdom of Denmark, Berlin 29 June 2007
2006	Environmental	German Federal Ministry of Transport/Danish Ministry of Transport (2006b): A Fixed Link Across the Fehmarnbelt and the Environment, Environmental Consultation Response Report, October 2006
2006	Environmental	German Federal Ministry of Transport/Danish Ministry of Transport (2006a): A Fixed Link across the Fehmarnbelt and the Environment, Environmental Consultation Report, January 2006

2006	Regional	Copenhagen Economics/Prognos (2006): Regional Effects of a Fixed Fehmarn Belt Link, February 2006
2005	Environmental	National Environmental Research Institute (2005): Construction of a fixed link across Fehmarnbelt: preliminary risk assessment on birds, June 2005
2005	Environmental	COWI/DMU (2005): Fixed Link across the Fehmarn Belt – Effect on Emissions to Air, March 2005
2004	Financial	Ministry of Transport Denmark (2004b): Fixed Link across Fehmarnbelt, Financial Analysis, June 2004
2004	Technical	Copenhagen Economics/Prognos (2004b): Economy-wide benefits – Technical report, Dynamic and Strategic Effects of a Fehmarn Belt Fixed Link, June 2004
2004	Economic, regional	Copenhagen Economics/Prognos (2004a): Economy Wide Benefits – Main Report, Dynamic and Strategic Effects of a Fehmarn Belt Fixed Link, June 2004
2004	Economic	Ministry of Transport Denmark (2004a): Economic Assessment of a Fixed Link across the Fehmarn Belt, June 2004)
2003	Financial, traffic	Danish Ministry of Transport, German Ministry of Transport (2003): Fixed Link across Fehmarnbelt: Financial Analysis, Traffic Forecast and Analysis of Railway Payment, Summary Report, March 2003
2003	Financial	Femer Baelt (2003): Fehmarn Belt Fixed Link, Financial Analysis, Main Results, February 2003
2003	Financial	TetraPlan (2003): Fehmarn Belt Fixed Link, Analysis of Rail Infrastructure Payment, March 2003
2003	Traffic	Fehmarnbelt Traffic Consortium (2003): Fehmarn Belt Forecast 2002, April 2003
2002	Financial	Fehmarnbelt Development Joint Venture (2002) : Fixed Link across Fehmarnbelt, Financing and Organisation, Enquiry of commercial interest, June 2002
2001	General	Fehmarnbelt Development Joint Venture (2001): Fehmarnbelt, An infrastructure investment, Information Memorandum, July 2001
1999	Economic, financial	Planco/COWI (1999): Economic and Financial Evaluation of a Fixed Link Across the Fehmarn Belt, Final Report, June 1999
1999	Traffic	Fehmarnbelt Traffic Consortium (1999): Fehmarnbelt Traffic Demand Study, Final Report, January 1999
1999	Regional	KOCKS/ISL/CARL BRO (1999): Investigation of socio-economic and regional consequences of a fixed link across the Fehmarn Belt, Final Report, June 1999
1999	Technical, environmental	Lahmeyer/COWI (1999): Fehmarn Belt Feasibility Study, Coast-to-Coast Investigation, Investigation of technical solutions, January 1999

Source: Femern A/S (<http://www.femern.com/service-menu/publications>) and others

ANNEX 7: TWO TUNNELS ON SE40 EXPRESSWAY SEVILLA-HUELVA

Table C7-19: Project summary two tunnels of SE40 EXPRESSWAY SEVILLA-HUELVA

Aspect	Description	Aspect	Description
Project Title	Construction works of two road sections of a ring road around Seville (two tunnels)	TEN-T code	2009-ES-08092-E
Countries / area	Spain	Start date	June 2009 (official)
Mode(s)	Road with tunnel section	End date	December 2010 (official)
Managing authority	Sociedad Estatal de Infraestructuras de Transporte (SEITT); Ministerio de Fomento	Duration	1 year 7 mth.
		Delay (mth)	Significant
Investment cost (m€)	239.69 (total project cost 525)	Length (km)	2.76 (north) 4.14 (south)
EC funding TEN-T (m€)	23.969	EC share	10% (~5% of total cost)
Funding agent 1	Ministry of Public Works and Transport (Ministerio de Fomento)	Value (m€)	215.72
Funding agent 2	European Commission TEN-T European Economic Recovery Prog.	Value (m€)	23.97
Cost-benefit-analysis	National Guideline by the "Servicio de Planteamiento de Dir. Gral. de Carreteras" and conducted by the AYESA firm	CBA ratio	6.36 (6.04 to 6.54)
		Public y/n	« yes »
Transport scenario	Forecast until 2023. Source unclear. Updated forecast until 2030 from 2008.	Dated from	Undated (2008)
Externality covered	Analyses divided in: Physical, Biological, Socio-economic, Cultural and Patrimony, and Landscape	Ext. cost (m€)	Not quantified in monetary units (except for environm.)
EIA	Yes (for the whole SE 40 project)	Public y/n	« yes »
CIA	Not included	Public y/n	n.a.
Financial analysis	Made by the AYESA firm together with the CBA (see above)	Payback	7 years
		FIRR	26.31 %
Ex-post evaluation	Proposed guidelines for ex-post environmental assessment: "Programa de vigilancia y seguimiento ambiental"	Cost overrun (m€)	Not available

Source: m€ = million Euro, own analysis



The project SE-40 Expressway Sevilla-Huelva is part of the longer road section Cordoba-Seville-Huelva that in turn forms part of the European priority project 8. Actually, SE-40 constitutes a ring road around the City of Seville. The funded project that is analysed by this case study concerns the construction of a tunnel crossing under the River Guadalquivir which is a section of this ring road SE-40 in the southwest of Seville.

The tunnel crossing is split into two parts, of which the northern part has a length of 2.76 km and the southern part of 4.14 km. In narrow terms this section would not have been part of priority project 8, which passes Seville on the northwest, while the project is located in the southwest of Seville. However, the TEN-T funding provided to the construction of the two tunnels comes from the European Economic Recovery Plan (EERP), i.e. the economic stimulus package that was defined in 2009 to mitigate the economic crisis of the years 2008/09. In that sense the project fulfilled the funding criteria as already in 2008 the Ministry of Public Works and Transport (MinFOM) published the call for proposals for the northern tunnel (MinFOM 2008a) as well as for the southern tunnel (MinFOM 2008b). Thus, it was deemed to be sufficiently mature to spend the economic stimulus money during 2009 and 2010. However, the mid-term review of the EERP reports a completion date of 2014 and states that "*The eligibility period has elapsed without the project having made significant progress or meeting its objectives.*" (Giorgi 2011, p.53). On the other hand the SEITT (Sociedad Estatal de Infraestructuras del Transporte Terrestre) reports on their website that the project is in execution (SEITT 2012).

7.1 Methodology and remarks on CBA and project selection

For the purpose of our analyses we obtained from the Spanish authorities the economic analysis of an upgrade of the northern part of the SE-40 ring road, which is actually part of the priority project 8 as it connects the motorway from the southwest coming from Huelva with the motorway towards Cordoba in the northwest passing Seville via the SE-40 ring road (Ayesa undated). The cost analysis differentiated the construction cost of three main route options with in total 12 sub-options. For the transport demand analysis also different options for further sections of SE-40 are considered, i.e. 4 main route options for the western section and 2 main route options for the southwestern sections (i.e. the section including the two tunnels). 10 combinations of main route options for the three sections have been tested as other are similar to one of these 10 combinations or were not feasible.

The CBA has been conducted applying a national guideline for benefit analysis recommended by national road planning bureau (*Recomendaciones para la evaluacion economica coste-beneficio de estudios y proyectos de carreteras*, published by Servicio de Planeamiento de la Direccion General de Carreteras). The transport demand scenario has been forecasted for the years 2003, 2008, 2013 and 2023. Potential benefits are estimated for the following categories:

- Transport cost of car users including vehicle cost, fuel cost (between 29.6 and 30.2 pts/l), cost of lubricants (between 512 and 570 pts/l) and cost of tyres.
- Time savings applying a value of time between 1,965 and 3,475 pts/h in values of 1998.
- Cost of accidents applying a cost values of PTS 34 million per death and of PTS 4.5 million per injured person in values of 1998 (i.e. about EUR 204 000 per death and EUR 27 000 per injured).

For the total upgraded/new sections of the SE-40 ring road (north, west and southwest part i.e. including the two tunnels) the benefit cost ratio is estimated at 6.36, the (financial) internal rate of return at 26.31 % and the payback period at seven years. The 12 sub-options for the northern part of SE-40 were estimated individually, as well. Their benefit-cost ratios were between 3.67 and 10.40, and their FIRRs between 15.74% and 34.07%. The discount rate applied was 3.5 % (Ayesa undated).

There has been an updated economic analysis that seems to build on Ayesa (undated) and includes specific estimations for the two tunnel sections, as well. The methodological approach is the same as described above. The benefit-cost ratio for the tunnel sections were estimated to be between 6.04 and 6.54 (N.N. undated).

7.2 Methodology and remarks on environmental analysis

The environmental impact analysis (EIA) seems to be profound on the base of the state-of-the-art of the late 1990ies. It was carried out on the base of Spanish legislation from 1986 to 1988 (N.N. 1999). It analysed 12 different options of route choice and compensation measures for adverse environmental impacts. Out of these 12 options 8 options were qualified as not feasible due to environmental concerns. Out of the remaining 4 options a ranking is provided and the option with the most limited environmental impact is proposed (was option 5).

For all 12 options also measures to mitigate and compensate environmental impacts have been assessed. The compensation measures would cost in the range between PTS 270 and PTS 380 million. The proposed option 5 caused mitigation cost of about PTS 307 million, roughly in the middle of this range.

Analysed environmental impacts included:

- Impacts on atmosphere (pollutants), hydrology, geology and climatic conditions (not emissions of greenhouse gases).
- Impacts on flora and fauna,
- Impacts on health and territorial planning,
- Cultural heritage,
- Nature and landscape, and
- Erosion and impacts of geological risks.

Climate impact assessment was not part of the EIA, even not only in terms of potential changes of emissions of greenhouse gases.

7.3 Characteristic of the transport demand scenario and its economic drivers

Two different transport demand scenarios have been used for the studies on the SE-40. One scenario that seems to stem from around 2000 and provides transport demand projections until 2023 with intermediate years 2003, 2008 and 2013 that is used in the economic analyses by Ayesa (undated) and N.N. (undated). The same transport projections were used for the Environmental Impact Analysis, that seems to stem from the same period (N.N. 1999).

An update of the transport demand scenario was prepared in 2008 (Ayesa 2008) to estimate the cost of the equipment and installations to be implemented in the two tunnels. The forecast was then provided until 2030. It is not known if there exists an update of the economic appraisal, as well, using these transport projections. It should be also pointed out that this revised transport forecast does not include the impacts of the financial crisis of 2008/09. We did also not identify any indication that this update made reference to the Spanish strategic infrastructure plan from 2005, called PEIT (MinFOM 2005).

7.4 Investment cost and structure of financing

The investment cost estimates changed slightly over the recent past years. The history can be detected from three sources provided by the Spanish authorities on the internet. For the northern tunnel of the southwest part of SE-40 this development reads:

- Call for proposals 2008 (MinFOM 2008a): EUR 233 million (excl. VAT).
- TED confirmation of contract 2009 (TED 2009a): EUR 203 million (excl. VAT).
- Website of projects of SEITT (Sociedad Estatal de Infraestructuras del Transporte Terrestre, 2012): EUR 245 million (incl. VAT).

For the southern tunnel of the southwest part of SE-40 the cost development reads:

- Call for proposals 2008 (MinFOM 2008b): EUR 245 million (excl. VAT).
- TED confirmation of contract 2009 (TED 2009b): EUR 232 million (excl. VAT).
- Website of projects of SEITT (Sociedad Estatal de Infraestructuras del Transporte Terrestre 2012): EUR 280 million (incl. VAT).

In both cases, it seems that the initial cost estimate was higher than the offers obtained from the successful bidders. This could be the result of economic crisis of 2008/09, of the tough competition on the Spanish market or of both.

According to the SEITT data the two tunnel sections together will cost EUR 525 million including VAT. This is significantly above the cost listed by the TEN-T EA of EUR 239 million. However, the TEN-T EA fiche explains that these costs would cover only the first part of works. Thus the 10% TEN-T funding of EUR 24 million would amount only to roughly 5% of the project cost.

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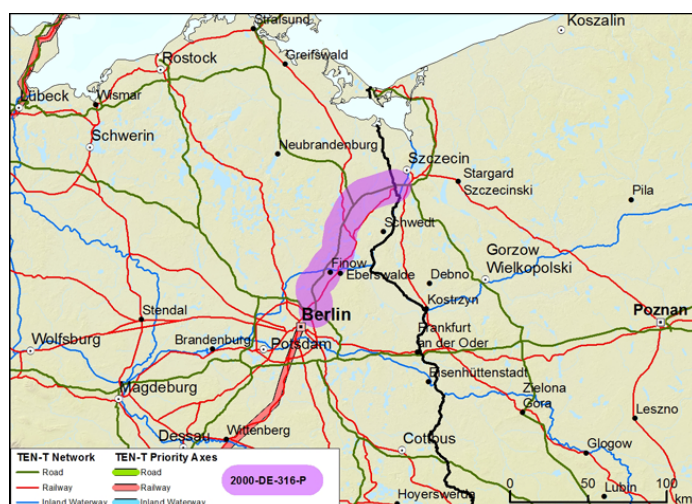
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ANNEX 8: A11 MOTORWAY FROM BERLIN TO POLISH BORDER

Table C8-20: Project summary of A11 motorway from Berlin to the Polish border

Aspect	Description	Aspect	Description
Project Title	Construction works on the A11 motorway Berlin-Polish border	TEN-T code	2000-DE-316-P
Countries / area	Germany (DE)	Start date	2000 (1996)
Mode(s)	Road	End date	2010 (2014)
Managing authority	Ministry of Transport Brandenburg Ministry of Transport Mecklenburg-Vorpommern	Duration	11 (19)
		Delay (mth)	(48)
Investment cost (m€)	131.5	Length (km)	110
EC funding TEN-T (m€)	10	EC share	7.6%
EC funding Cohes. (m€)	0	EC share	0
Funding agent 1	German Federal Ministry of Transport	Value (m€)	121.5
Funding agent 2	European Commission	Value (m€)	10
Cost-benefit-analysis	Missing for the basic decision to renew A11 motorway	CBA ratio	
		Public y/n	
Transport scenario	Federal Infrastructure Plan 1992/2003 BMVBS Verflechtungsprognose 2025	Dated from	1992 / 2003 (2007)
Externality covered	Water, soil, climatic conditions, flora and fauna, nature and landscape	Ext. cost (m€)	Not quantified
EIA	Plan approval procedure of several sections of A11 (Landschaftspflegerischer Begleitplan Grundhafter Ausbau BAB 11)	Public y/n	(y)
CIA	Could not be identified – not in EIA	Public y/n	
Financial analysis	Missing	Expected RoI	
Ex-post evaluation	Missing	Cost over-run (m€)	

Source: own analysis



The A11 motorway dates back to the 1930's connecting Berlin with Szczecin in Poland. Today the part from Berlin to the Polish border constitutes the motorway A11 in Germany. The A11 forms part of the European Highway E28 that should connect Germany via Poland to the Baltic States. Though the concept of this east-west axis existed since the 1930's the whole motorway was never completed, yet. Until 1990 very little efforts were made to maintain or extend the A11 motorway.

After the German reunification in 1990 the German government defined the so-called "Verkehrsprojekte Deutsche Einheit" (VDE) (transport projects to implement German reunification), of which a large part was to renew poorly maintained existing transport infrastructure, and, where necessary, increase capacity to accommodate the expected transport growth between Western and Eastern Germany, and beyond towards the Eastern neighbouring countries. The latter became an even higher priority after the decision that Eastern neighbouring countries would accede to the EU. Since 1996 the A11 is continuously renewed section-by-section, but even until 2007 there have been sections, which still were constructed by the concrete slabs from the 1930's. Completion of the renewal building new pavements, adding emergency lanes, re-constructing all bridges and adding new bridges including green bridges allowing animal crossings is expected to last until 2014.

On the Polish side of the border after 1945, first of all, the destroyed bridge across the river Oder had to be rebuilt. Afterwards there were plans to complete the motorway until Kaliningrad, but until the fall of the iron curtain in 1990 nothing happened. At present, the Polish Part of the motorway is named A6 and since 2011 there are construction works ongoing. As part of the European Highway E28, it is now again planned to extend the motorway in a similar manner, as it was initially planned before the second world war.

8.1 Methodology and remarks on CBA and project selection

The A11 is connected with the so-called "Verkehrsprojekte Deutsche Einheit" (VDE), though in narrow terms it is not part of any VDE. However, the reporting about the progress of road construction of the VDE most often includes part of the A11 within the reporting on the motorway A20 as a connection Lübeck to Stettin (Szczecin) (Bundesregierung/BMVB 2002, 2006). The "Verkehrsprojekte Deutsche Einheit" (VDE), which comprised 17 projects to re-establish the transport connections between West- and East-Germany (9 rail projects, 7 road projects and one inland waterway project), were decided within a period of 6 months between October 3rd 1990 and April 9th 1991. The projects were a political decision to react on the fast and unexpected German reunification process. Therefore a CBA was not applied. During these 6 months the initial cost estimate for the 7 road projects was about EUR 12 billion. Until the nearly completion of the projects in 2010 the cost increased by about 40% to EUR 16.6 billion, in particular due to construction of tunnels additionally required in hilly areas (DEGES 2011). However, though for the basic decision to build the VDE projects no CBA was carried out, it can be concluded that for the decision on exact routes at least a plan-approval procedure was conducted, though this does not necessarily imply that a CBA was performed.

The part of A 11 receiving funding from TEN-T was built between 2000 and 2010 at a total cost of EUR 131.5 million supported by a TEN-T budget of EUR 10 million. We could not obtain any CBA on that project, which was essentially a renewal project of a deteriorated infrastructure and not a construction of a new infrastructure.

8.2 Methodology and remarks on environmental analysis

The plan approval procedure for A11 was split into five sections, of which we obtained the EIA, and a remaining part of about 20 km length of which we did not obtain an EIA. For each section a separate EIA is carried out, following the German guidelines (German Transport Authorities, undated). The considered impacts include impacts on water, soil, climatic conditions, flora and fauna, nature and landscape. Two patterns can be observed for the assessment of the different sections: on the one hand the impacts were assessed to be less dramatic as construction of the A11 in the 1930's already led to impacts on and a separation of the living space on both sides of it. On the other hand the areas crossed by the A11 are sparsely populated and several sites of ecologic importance have been identified and needed to be considered during the plan-approval procedures.

Emissions of greenhouse gases were not considered in the EIAs, neither were life-cycle impacts on CO₂ emissions of infrastructure or vehicles.

All impacts were assessed qualitatively, only. Monetisation of externalities and potential inclusion into CBA was not part of the tasks of the EIAs.

8.3 Characteristic of the transport demand scenario and its economic drivers

The initial decision on the VDE in 1990 was underpinned by expert opinions, which included also judgements on transport forecasts. Only when in 1992 the revision of the German Federal Transport Infrastructure Plan was published a transport forecast considering the German reunification of 1990 was developed. This transport forecast was updated for the revision of the Federal Transport Infrastructure Plan in 2003, followed by another revision in 2007 (BMVBS 2007). We are not aware if and how these forecast affected the planning and construction of A11.

Looking at the speed of implementation of other VDE compared to A11 it seems that the transport forecast for the A11 is very moderate. While the motorways connecting East and West Germany have been completed years ago, the A11 also more than 20 years after reunification is still under renewal in some sections. This highlights the importance for the European decision-makers to closely look at cross-border projects, to which A11 belongs, as for these the national interest often is lower than for other national projects.

8.4 Investment cost and structure of financing

The reported investment costs were EUR 131.5 million of which EUR 121.5 million were funded by the German Federal Ministry of Transport and Housing and another EUR 10 million by the European Commission (2011). However, the total costs should be yet unknown as renewal of final sections of A11 is still ongoing.

8.5 Cost developments over the life-cycle of the project

There is no source existing on the time profile of cost of A11. On average the VDE road projects faced a cost increase of 40%. In the case of A11 the long duration of planning and construction probably will contribute to cost increases, though not even one source could be identified that estimated costs for the whole project (110 km).

8.6 References

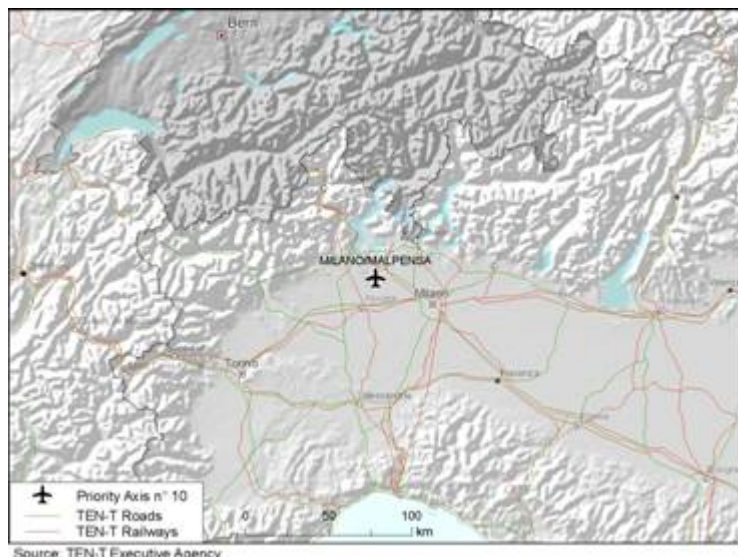
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ANNEX 9: MALPENSA 2000 AIRPORT

Table C9-21: Project summary of major project Malpensa 2000 Airport

Aspect	Description	Aspect	Description
Project Title	Malpensa 2000 Airport	TEN-T codes	PP10
Countries / area	Italy	Start date	1990
Mode(s)	Air	End date	1998
Managing authority	SEA (Società Esercizi Aeroportuali)	Duration	8
		Delay (mth)	0
Additional projects	Cargo City Development - Railway Tunnel, 2007-IT-91502-P	Start date	Dec 2008
		End date	Oct 2011
	MXPT2LINK-UP, 2010-IT-91112-S	Start date	Nov 2010
		End date	Oct 2012
Investment cost (m€)	945	Length (km)	n.a.
EC funding TEN-T (m€)	26.8	EC share	2.8 %
Funding agent 1	Ministry of Infrastructure and Transport (Ministero delle Infrastrutture e dei Trasporti MIT)	Value (m€)	439.1
Funding agent 2	EIB (European Investment Bank)	Value (m€)	310.1
Funding agent 3	SEA (Società Esercizi Aeroportuali)	Value (m€)	168.9
Funding agent 4	European Commission TEN-T fund	Value (m€)	26.8
Cost-benefit-analysis	Internally conducted by SEA and EIB	CBA ratio	n.a.
		Public y/n	« no »
Transport scenario	Regione Lombardia	Dated from	1984
Externality covered	« no »	Ext. cost (m€)	Only qualitatively
EIA	Yes, in 1987, 1997 and 1998	Public y/n	« yes »
CIA	Not included	Public y/n	n.a.
Financial analysis	SEA	Payback period	7 years
Ex-ante evaluation	SEA	Public y/n	(Y)
Ex-post evaluation	SEA	Cost overrun (m€)	-45 (saving)

Source: own analysis largely based on EVA-TREN 2012



Malpensa Airport is located in Italy's Lombardy region 46 km northwest of Milan and opened in 1998. It has a direct highway connection and a shuttle train link to Milan. Being in former private and military use it was first promoted as a complementary airport to the city airport Linate, while its objective changed with the inclusion into the TEN-T priority project list in 1993. Today, it is the second biggest airport in Italy and no. 21 in Europe while serving around 19 million passengers per year and moving about 440,000 tonnes cargo.

The project Malpensa 2000 included renewing and extending the old runways, building new taxiways, aprons, a new passenger terminal, a new control tower, a cargo centre, a train station and an access road from the old terminal. This first stage was necessary for ensuring the new terminal operations; later stages, which are still ongoing, are dealing with capacity extensions for both passenger and cargo transport.

After including the project in the TEN-T priority project list, the project objective was changed from merely increasing the airport capacity of Milan together with allowing wide body aircrafts to installing a Northern Italian hub. However, financial difficulties, problems with trade unions of Alitalia as well as inconsistencies in the airport development strategy of the airports serving Milan (i.e. Malpensa, Linate, Bergamo Orio al Serio) led to an abandonment of this plan. An originally foreseen forced switch of traffic from Linate to Malpensa was later reversed.

The accessibility by surface transport was not consistently included in the prior planning; some work is still ongoing. This is also due to the inconsistent strategy of the airport being partly planned for hub and spoke operations and now being used for point to point operations. Reasons for the TEN-T inclusion were the endeavour to make the airport a primary gateway to southern Europe including to provide an Alpine crossing as a geostrategic goal.

9.1 Methodology and remarks on CBA and project selection

The project was selected for the TEN-T priority project list while being already in an advanced state of planning and construction. Apparently, it has not been a formal requirement of the Italian government to undertake a CBA. There is no publicly available CBA; only internal ones carried out by SEA and later on by EIB seem to exist, though we could not obtain them. Other options for expanding Milan's airport capacity were not deeper evaluated as this analysis as well as the environmental analysis were accomplished by the airport franchisee SEA and thus no interest in examining alternatives existed (EVA-TREN 2012).

Financial analyses have been carried out ex-ante by SEA, stating complete cost coverage until 2001. After the official opening in October 1998 some further investments in handling system execution and security were made, which is the reason for two updated project cost

calculations, one made by the European Commission (2005), reporting EUR 1 344 million and one by SEA (2007), reporting EUR 945 million, whereas the lower one includes all planned and executed work till the opening of the airport. A third analysis of SEA submitted to DG TREN (IT-99-105) reports a cost breakdown of EUR 894 million, which is also due to differences in funded facilities included in the cost estimates. No analysis states a cost overrun, which according to EIB is due to absence of project delays.

Investments in surface transport accessibility were not part of the Malpensa 2000 project and thus are financed and accomplished later.

9.2 Methodology and remarks on environmental analysis

The Malpensa 2000 project was initially planned due to environmental concerns, mainly noise pollution at the Milan city airport Linate. In accordance with the overall planning of the airport an environmental impact analysis (EIA) was conducted in 1987; however, it was considered being incomplete and thus another EIA has been accomplished just before the airport opening in 1997, leading to a negative statement by the Ministry of Environment and a governmental decree approving it. The Ministry of Environment demanded a new EIA in 1998, mainly for reasons of underestimated traffic, resulting both from a general large increase in passenger flight demand as well as a side-effect of the inclusion of Malpensa in the TEN-T network, which required a proper EIA to obtain funding.

Modal-share of car access trips to Malpensa amounts to about 70%, mostly private cars. However, this was not considered in the EIA as opposed to the better accessibility of Linate. Apparently the conducted EIA was not state-of-the-art; further environmental impacts like the proximity of the airport to the Ticino river park were not well recognised. This led to a low acceptability in the population (Centemeri and Gervasi, 2011), leading to changes in operative issues like flight limitations etc. EVA-TREN (2012) concluded that the EIA was carried out too late in the planning process. Measures limiting environmental costs were difficult to implement at that late point of time and thus could not be identified.

Di Valfrei and Papponetti (2002) list some environmental indicators relevant to measure environmental performance of airports; at the state of study completion only very few parameters besides noise are available from SEA.

9.3 Characteristic of the transport demand scenario and its economic drivers

EVA-TREN (2012) lists several transport demand scenarios connected with the development of the Milanese airports: British Airports International (1980), Regione Lombardia (1984), IATA (1993), Cranfield University (2000) and Odoni (1996). All underestimated future demand. However, this did not lead to serious operational problems as the maximum capacity of the airport was underestimated as well. The early forecasts did not even differentiate the demand between the two airports Linate and Malpensa, which was corrected for in later studies.

All traffic forecasts carried out ex-ante to the opening of the Malpensa airport underestimated the induced traffic resulting from the new airport as well as the changes in the 90ies that caused a boom of the air transport sector. The two most recent forecasts slightly overestimated actual demand.

The effects of the underestimation were not severe for several reasons (Beria and Scholz, 2010):

- Malpensa airport was planned for a much higher capacity than the forecasts indicated.
- Linate was not shut down and its maximum capacity was largely underestimated, as well.
- A number of low cost carriers shifted to Bergamo Orio al Serio airport.

Thus the metropolitan area of Milan is still capable to handle more traffic than the actual demand.

9.4 Investment cost and structure of financing

The investment costs were constantly reviewed by the airport operator SEA, but they were not regularly published. The final cost was reported by the airport operator SEA at EUR 945 million (SEA 2007), though it lacks details on what is included in this figure. The cost estimates of the European Commission (2010) of EUR 1 344 million includes according to EVA-TREN (2012) investments after the official opening; this view can be supported as it is stated in European Commission (2010) that the TEN-T project was completed in 2001, so some years after the opening of the airport. The Malpensa 2000 airport funding of EUR 945 million is split amongst different public and private sources:

- Private funding by the airport operator SEA: 18 %.
- A loan from the EIB: 33 %.
- TEN-T funding to subsidise interest payments: 3 %, and
- A national government grant: 46 %.

These figures refer to the ex-post analysis of the franchisee (SEA, 2007). Two other estimates exist; they differ in the amount of construction works and facilities included in the analysis. All ex-ante estimates remained below the actual cost.

EVA-TREN (2012) and Beria and Scholz (2010) criticise the lack of a meaningful public CBA, which could have revealed that public funding could be lowered and private funding increased due to the profitability of the investment. They conclude that "*such analysis could have shown the opportunity of granting such an amount (or a lower one or no funding at all) due to the large self-financing capability of the airport*" (EVA-TREN 2012).

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ANNEX 10: THE SEINE-SCHELDT INLAND WATERWAY NETWORK - CROSS-BORDER SECTION BETWEEN COMPIÈGNE AND GHENT

Table C10-1: Project summary Seine-Scheldt inland waterway

Aspect	Description	Aspect	Description
Project Title	The Seine-Scheldt inland waterway network - cross-border section between Compiègne and Ghent	TEN-T code	2007-EU-30010-P
Countries / area	France, Belgium	Start date	January 2007
Mode(s)	Water	End date	December 2013
Managing authority	VNF	Duration	
		Delay (mth)	
Investment cost (m€)	Total investment costs: 4,258.7 (for Seine Nord Europe canal, TEN-T EA figure) 5,9 (for the whole Seine-Scheldt Link, VNF figure)	Length (km)	106 (Seine-Nord Europe Canal)
EC funding TEN-T (m€)	420.19 (total project as approved for 2007-2013)	EC share	9.867%
EC funding Cohes. (m€)	d.n.a.	EC share	d.n.a.
Funding agent 1	National budgets	Value (m€)	874.5
Funding agent 2	Regional/local budgets:	Value (m€)	962.1
Funding agent 3	Action promoter (public or private)	Value (m€)	1,986.3
Funding agent 4	Others	Value (m€)	15.7
French Sector			
Cost-benefit-analysis	VNF (2006a): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol H – Socio-economic assessment, December 2006	CBA ratio	See section 1.1. below
		Public y/n	Y
Transport scenario	VNF (2006a): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol H – Socio-economic assessment, December 2006	Dated from	December 2006
Externalities covered	VNF (2006a): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol H – Socio-economic assessment,	Ext. cost (m€)	

	December 2006, p. 68 : <ul style="list-style-type: none"> • safety (accidents) • atmospheric pollution • greenhouse gas emissions 		
EIA	VNF (2006b): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol, F - Impact Study: Non-technical summary, December 2006.	Public y/n	Y
CIA	Covered by: VNF (2006b): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol. F - Impact Study, Non-technical summary, December 2006.	Public y/n	Y
Financial analysis	Not available	Expected RoI	
Ex-post evaluation	d.n.a.	Cost overrun (m€)	
Belgian (Flemish) Sector			
Cost-bene-fit-analysis	Belconsulting (2005): Maatschappelijke kosten-batenanalyse. Technische & Economische Analyse.	CBA ratio	Alternative 1: 0.73 Alternative 2: 0.90 Alternative 3: 1.45 Alternative 4: 0.77
		Public y/n	Y
Transport scenario	VNF (2006a): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol H – Socio-economic assessment, December 2006, p. 51	Dated from	December 2006
Externalities covered	External effects: emissions, noise, congestion and social aspects (safety)	Ext. cost (m€)	
EIA	Belconsulting (2005): Actualisatie economische studie: milieuimpactanalyse. Within this study the following impact aspects have been analysed: Water; Soil; Sound; Air; Human life; Fauna & Flora.	Public y/n	Y
CIA	None	Public y/n	
Financial analysis	Not available	Expected RoI	
Ex-post evaluation	d.n.a.	Cost overrun (m€)	

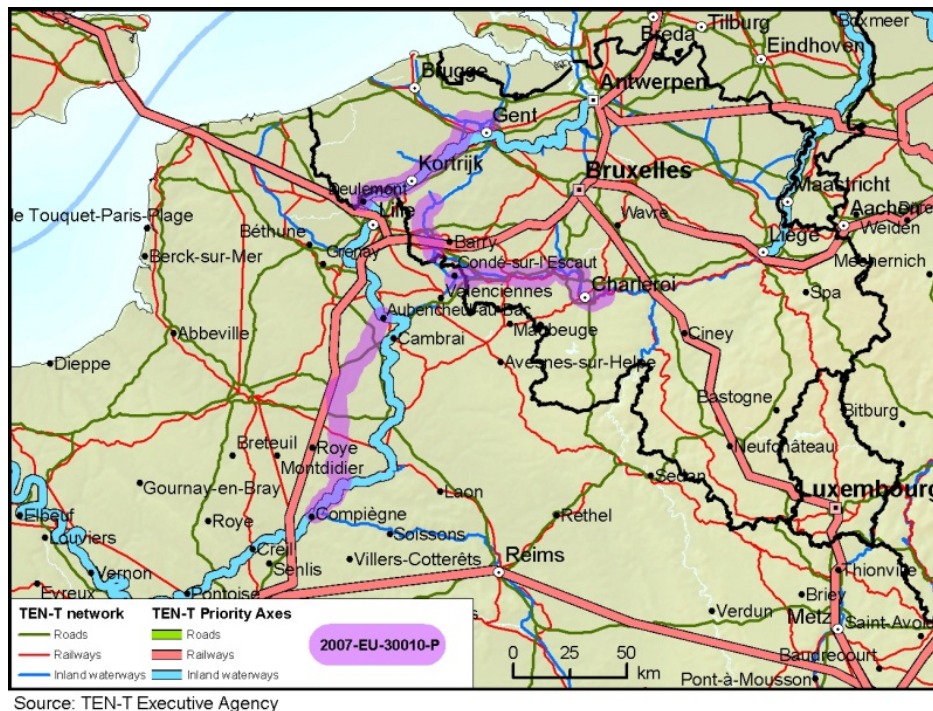
Source: own analysis

"The Seine-Nord Scheldt project is part of Priority Project 30 Inland Waterway Seine-Scheldt is designed to connect the Seine and Scheldt river basins, and, to a broader extent, the entire Rhine-Scheldt delta and the Rhine basin (Priority Project 18 - Waterway axis Rhine/Meuse-Main-Danube). It will not only help alleviate serious road congestion which affects the north-south economic axis, but also open up a new European freight corridor between Le Havre, Paris, Dunkerque, Antwerp, Liège and Rotterdam/Amsterdam.

Along this corridor, the project will allow the concentration of freight in push-tows carrying up to 4,400 tonnes. At the same time it will provide high-capacity access to the northern seaports -and a catchment market of more than 60 million people. The project investments will be aimed at eliminating the main bottlenecks, and will concern the following three sections:

- Seine-Ghent
- Condé-Pommeroeul to Sambre
- Upper Scheldt⁴⁴

Figure C10-1: Location of the Seine-Scheldt waterway network



The objectives of PP 30 will be achieved by upgrading, recalibrating and developing the broad-gauge waterways of the Seine and Scheldt basins:

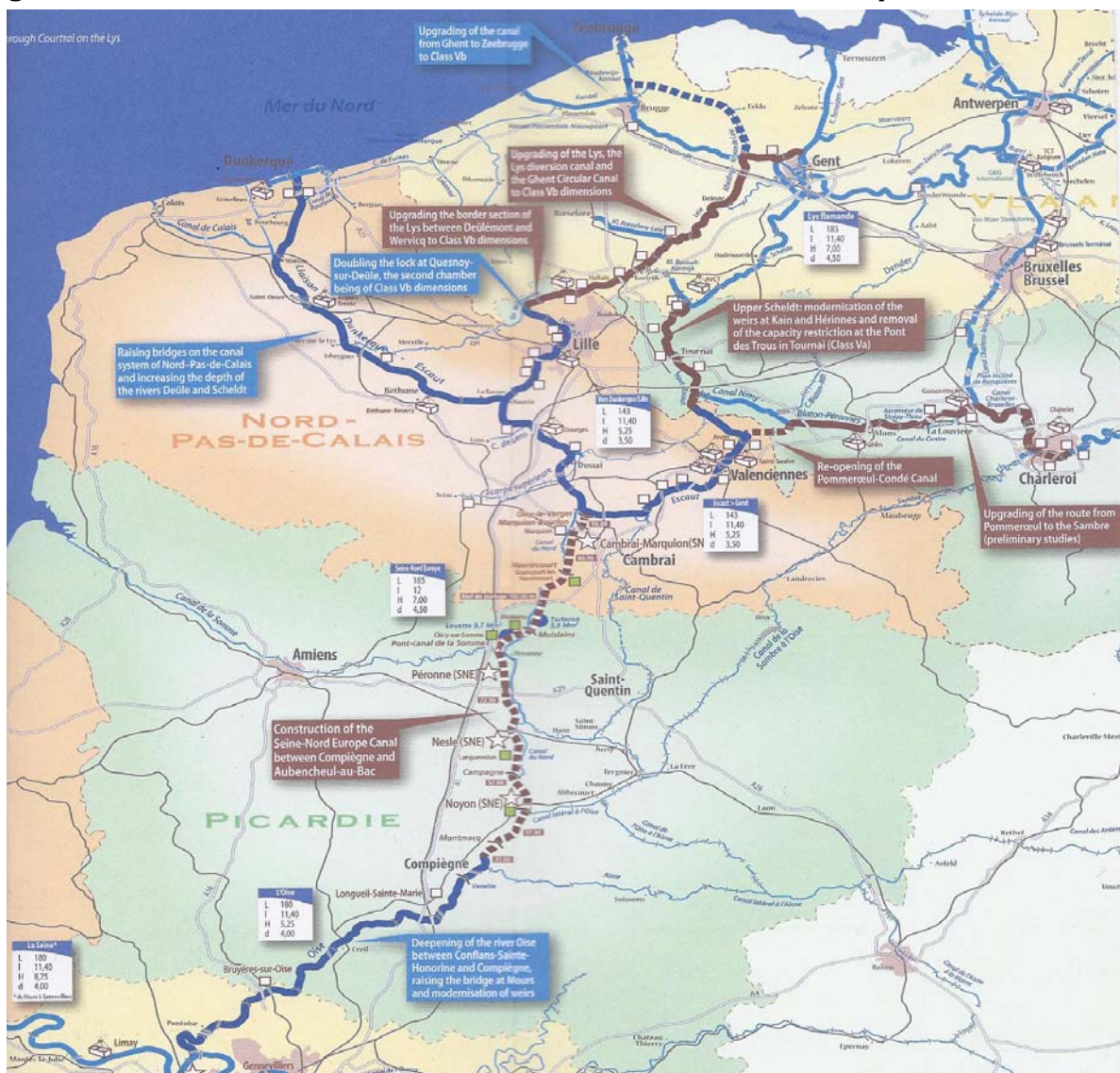
- In France: The Seine and the Tancarville Canal (Montereau-Gennevilliers-Rouen-Le Havre) with Port 2000 Lock; the downstream section of the Oise between Conflans-Sainte-Honorine and Janville; the Nord - Pas-de-Calais network which includes the Dunkerque - Scheldt Canal connecting Dunkerique to Valenciennes with three sections to Belgium via the Deûle and the Lys, via the Scheldt and via Condé-Pommeroeul Canal; the future broad gauge canal between the Oise and Nord - Pas-de-Calais, the Seine - Nord Canal with, in particular, the creation of four multimodal platforms located along the 106 km of the future Seine-Nord Europe Canal and the development of innovative transport solutions.
- In Belgium: The Lys, the diversion of the Lys, the Ghent - Bruges Canal, the Ghent circular Canal, and beyond the sea canal between Ghent and Terneuzen, the Ghent Canal to Bruges and Ostend; the upper-Scheldt between Mortgage and Ghent, the Condé-Pommeroeul Canal, the corridor through Wallonia from Pommeroeul to the Sambre including the Nimy-Blaton Canal, the Centre Canal, the Charleroi - Brussels Canal and the Sambre.

⁴⁴ TEN-T EA (2012): The Seine-Scheldt inland waterway network - cross-border section between Compiègne and Ghent. Online : http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/multi_country/2007-eu-30010-p.htm (30.11.2012).

The French, Flemish and Walloon governments, co-operating in this project, have created a European Economic Interest Grouping as implementing body. Within the limited time frame we were able to establish contact with Voie Navigables de France, the French implementing body, and Waterwegen en Zeekanal NV, the Flemish implementation body, but not the Walloon authority. Because of the largely independent implementation activities on the French and Belgian sides, we present the French and the Flemish sectors separately.

“The project is on-going. On the French side, the land appropriation and archaeological surveys required to construct the Canal “Seine-Nord Europe” (SNE) are well advanced. Some important networks have been deviated to facilitate the future works, not the least the lowering of the A29 highway. The Competitive dialogue related to the construction and operation of the Canal SNE is underway. On the Lys River, both in France and Belgium, activities are progressing and some environmental issues are still due to be solved, in particular with the development consent expected in 2012 on the French side and on the Belgian side for Condé-Pommeroeul.”⁴⁵

Figure C10-2: Overview over the Seine-Scheldt inland waterway network



Source: EEIG Seine-Scheldt: The Seine-Scheldt Link – a new waterway vital to Europe’s transport network, Bethune, November 2011

⁴⁵ ibidem

The delays occurred on the French side have had an immediate effect on the Belgian developments just across the border due to necessary coordination. In particular on the sections concerning Lys and Pommeroeul-Condé, delays by the French partner have had a repercussion on these Walloon projects. A thorough analysis of the actual situation is planned this autumn in order to assess the necessary measures to reduce delays that may affect the eligibility period for works already set for the end of 2015. The canal is planned to be fully operational in 2019.⁴⁶

France

The projected Seine-Nord Europe Canal will form, within the high-capacity waterway network which serves the major economic centres of Northern Europe, a new system for freight transport between France, Belgium, the Netherlands and Germany. This geographical area is characterised by intense cross-border traffic movements and by one of the highest levels of road saturation of the European continent, on this north-south-route: 132 million tonnes of freight transited this north-south corridor in 2000. The new canal will provide interconnection between the Seine river basin, in particular the Paris (Ile-de-France) region as well as the Le Havre and Rouen seaports, with the Rhine river and adjacent areas. The high-capacity Seine-Nord Europe Canal will be built between Compiègne and Aubencheul-au-Bac.

The Seine-Nord Europe Canal involves building, within the territory of the Picardy and Nord-Pas de Calais regions, a new canal 106 km long, with technical characteristics corresponding to "class Vb" of the European classification of waterways of international interest.⁴⁷

Voies Navigable de France (VNF) is the implementing body in France. The agency runs a dedicated website for the project (<http://www.seine-nord-europe.com/>) with information and a selection of documents for download. For our analysis, the thus available documentation is, however, insufficient, in particular regarding the financial planning.

10.1. Methodology and remarks on CBA and project selection

The economic evaluation was prepared in 2006 for the Enquiry prior to Declaration of Public Interest as part of the official French procedure for the planning of large-scale infrastructure projects. The economic studies were conducted by specialised French and Belgian consultancies. Earlier, taking into account the findings of the economic studies of the previous phases of the project (1998-1999) and the national debate of 2003 on major infrastructure projects, VNF set up at the beginning of preparation of the preliminary design studies – in June 2004 – an economic studies monitoring committee made up of eight French, Belgian and Canadian transport economists. This arrangement was made to ensure that all the issues of the project would be taken into consideration within a framework broadened both geographically and through the nature of the project benefits, by comparison with the preliminary studies. The committee worked in collaboration with the economic consultants on the methodological choices and contributed its expertise to drafting of the socio-economic assessment. The main tasks carried out by the committee were:

- the construction of macroeconomic scenarios, involving in particular validation of the basic economic reference assumptions (growth, transport policy);

⁴⁶ European Commission (2012): Annual report of the Coordinator, Priority Projects 18 and 30, Karla Peijs, p. 9

⁴⁷ VNF (2006a), p. 7

- methodological choices on modelling adapted to the very particular characteristics of freight transport by inland waterway ;
- methodological choices relating to calculation of the advantages under the socio-economic assessment.

The CBA is carried out at two levels: France only, and Europe i.e. France, Belgium, Netherland, Germany. It is argued that about one-third of benefits materialise outside France. Furthermore, the CBA differentiates between the implementation of the project by public funding only or partly through public-private partnerships which changes the nature of the risks and the associated costs during the investment phase.

The calculation mechanism is not transparent in the available document. Only the results are documented.

The base case assumes an EU contribution of 19% to the project; in addition, sensitivity test are carried out for a lower/higher EU contribution, 10 and 30% respectively. We gather that the EU contribution is used to reduce project costs of investment. This procedure is questionable since EU financial contributions do reduce only financial costs of the participating countries, but not economic costs. A similar argument relates to the participation of the private sector.

A CBA run for funding without EU grants and without support by the private sector has not been carried out. Hence we can only estimate that in such a case the internal rate of return would be in the order of 4.2%, a still respectable rate for an inland water transport project.

A separate "logistics scenario" has been considered which in fact is an alternative transport demand scenario with higher traffic assumptions. EIRRs increase in this case marginally to slightly. They also increase by approximately one percent-point when external costs are internalised

According to VNF, a complementary study was carried out and approved by the EEIG in 2010. This study aimed at defining more precisely the expected impacts of the project, focused on French territories. The whole impacts (growth, traffic, added value) have been updated. The relevant documents were, however, not made available to us for review.

The CBA is assumed to be carried out in conformity with French government regulations. Sensitivity tests with regard to variations in toll levels below and above the central toll rate of EUR 2.5 per tonne (EUR 1.75 and EUR 3.25 respectively) have been carried out. The impact on the EIRR is roughly +/- 0.3 points), hence relatively limited.

The scenario updated in 2010 is based on a pivotal toll value of EUR 2.9 /tonne.

It appears that the project has not undergone a selection process in France. The proposal of the French and Belgian governments to present it for co-funding by the European Commission was quite clearly based on political considerations. The project was in fact presented to the EU at a very late stage of 2007-2013 programming and was added to the original list of 29 priority projects as n° 30.

10.2. Methodology and remarks on environmental analysis

The principal effects on the environment are those related to the actual construction works, with some residual effects to be considered during subsequent operation of the Seine-Nord Europe Canal. The development works aimed at improving the navigable characteristics of the existing waterways have only minimal impacts on the environment. The assessment comes to the following conclusions:

- the land requirement for the development works to the north and south of the Seine-Nord Europe Canal is limited. There is no significant impact on agriculture, on natural habitats or on heritage as a result of these works.
- according to the studies carried out for the Oise-Aisne agency (Entente Association), the recalibration of the river Oise upstream of Creil brings an overall improvement to the conditions of flood flows of the Oise without any impact on the water levels at the confluence between the Seine and the Oise.
- aquatic environments are not affected by implementation of the works, with the exception of some short-term impacts during the dredging works. By using vegetation for bank protection along the modified river sections the impacts of the river engineering works can be reduced. In the Compiègne-Creil section, a system of alternating one-way navigation will be used to reduce the extent of river bend easing and widening, without imposing any significant restrictions on navigation.
- the noise generated by the increase in waterborne traffic is substantially lower than the thresholds of noise considered as prejudicial for other infrastructure projects. The modal shift from road and rail to waterborne freight will lead to an overall reduction in noise.
- Water consumption resulting from the operation of the existing waterway network will increase on account of the increase in traffic. If necessary, water recycling plants will be installed at the locks to reduce and control water consumption effectively.
- The increase in waterborne traffic has only a limited impact on bank erosion.
- The quality of air is improved in the corridor close to major roads and motorways, without causing any pollution in the area immediately bordering the waterway; construction of the link gives rise to a reduction in carbon emissions producing the greenhouse effect, thanks to the modal shift from road to water transport.
- Doubling of the locks of the Seine–Nord Europe Canal involves no additional water consumption. The increase in waterborne traffic resulting from this development improves the modal shift, with positive effects on the energy balance and carbon emissions.

As far as we can judge there are no environmental aspects missing.

No specific climate impact assessment has been conducted regarding the Seine-Nord Europe project. All climate-related issues are being covered within the EIA.

10.3. Characteristic of the transport demand scenario and its economic drivers

In 2000, 258 million tonnes (Mt) of non-containerised freight and almost 631,000 containers (TEU) were transported between the regions of the concerned project area, of which 90 Mt and 320,000 TEU were concentrated in the north-south corridor, to be served by the Seine-Nord Europe project.

The presence of high-capacity waterways has a major impact on the market share of inland water transport. On sections where high performance is possible, such as on the Seine, water transport has a significant market share. On the other hand, the constraint of capacity on the north-south waterway route (Canal du Nord limited to 650 t) limits the water transport share to a little over 3 %.⁴⁸

By connecting the Seine basin to the European high-capacity waterway network, the Seine-Nord Europe Canal project will contribute to reducing isolation of this waterway system and to making possible an alternative solution to the growth of road traffic (74 % market share in 2000) for the supply of both consumer goods and equipment.

Connection of the Seine basin to the north European network induces an increase in waterway traffic of between 3.2 and 3.7 million tonnes in 2020 (see table below).

Table C10-2: Traffic forecast on the section Vernon-Gaillons

Traffic on the section Vernon-Gaillon (in million tonnes)

Scenarios of behaviour of economic stakeholders	2020		2050	
	Macroeconomic scenarios			
	Trend	Central	Trend	Central
"Continuing current trends"	18.5 Mt	20.0 Mt	23.0 Mt	26.2 Mt
"Development of inland water transport"	structuring effect measurable as from 2020		25.8 Mt	29.4 Mt
Traffic without Seine-Nord Europe	15.3 Mt	16.3 Mt	17.5 Mt	20.3 Mt

Source: VNF

Overall, the interconnection of the Seine basin induces an additional traffic of 25 %, originating partly in the increase in the amount of traffic using the Seine-Nord Europe Canal (+1.6 Mt in 2020 under this central scenario) and partly to the fact that the Seine basin itself becomes more dynamic through the greater competitiveness of inland water transport in a more open and fluid market (+2.1 Mt in 2020 under this scenario).⁴⁹

The data used to define the volumes of traffic by origin and destination are based on a combination of data from various sources in France (SITRAM, Seaports, Customs, VNF) and Europe (TEN-STAC). The modal share of the road transport, which has the dominant market share (87% versus 8% for rail and 5% for water transport), is explained by the saturation of the railway network described in the previous chapter (particularly on account of the priority given to passenger transport on the approaches to urban centres) and by the absence of interconnection of the high-capacity waterway network.

⁴⁸ Seine-Nord Europe Canal/public enquiry dossier, 18.

⁴⁹ Seine-Nord Europe Canal/public enquiry dossier, 44.

The traffic forecasts were developed by VNF and external consultants. The detailed traffic studies were not available for review.

10.4. Investment cost and structure of financing

In the Mid-Term evaluation it was concluded that the project is significantly behind schedule due to political, financial and technical issues. Thus, it will not be completed by the end of 2015. Given this delay, it will not be possible to maintain the EU support for the part of the activities to be carried out after 2015. This entails a reduction of the TEN-T contribution of approximately EUR 44.3 million. The completion of around 85% of the project by the end of 2015 is more realistic, provided that the following conditions are met:

- the competitive dialog of the PPP process is launched by the end of 2010
- the competitive dialog is completed and the contract awarded by the end of 2011
- the project continues to respect the revised implementation planning provided in the 2010 ASR.⁵⁰

A thorough analysis of the actual situation was envisaged for autumn 2012 in order to assess the necessary measures to reduce delays that may affect the eligibility period for works already set for the end of 2015. No information was released by VNF on this subject. The canal is anticipated to be fully operational in 2019.⁵¹

Table C10-3: Breakdown of costs in the present phase 2007-2013

Total project cost	4 258.7
EU contribution	420.2
National budgets	874.5
Regional/local budget	962.1
Action promoter (public or private)	1 986.3
Other sources	15.7

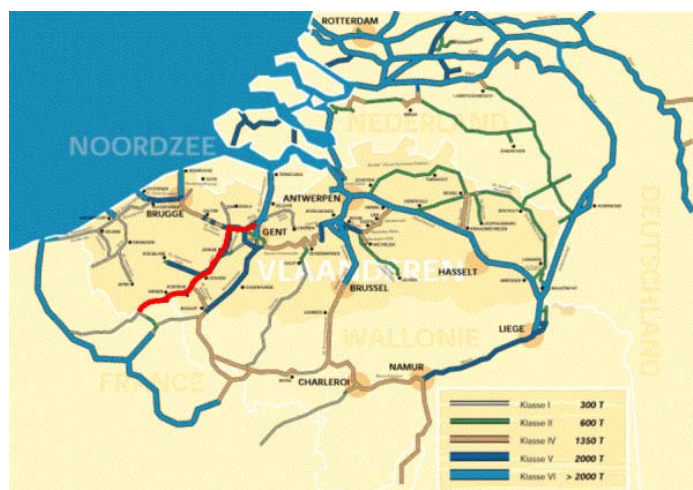
10.5. Cost developments over the life-cycle of the project

As the planning phase is still ongoing, investment cost estimate may change at any point of time. We do not have information on the most recent cost estimates. An audit of all large transport infrastructure projects in France has been ordered by the new French government. The results are expected shortly.

⁵⁰ TEN-T Trans-European Transport Network (. Mid-Term Review of the 2007-2013 TEN-T Multi-Annual Work Programme_ Project Portfolio (MAP Review), 179.

⁵¹ Karla Peijs (2012): Annual Report of the Coordinator. Priority Project 18 and 30, 9.

Belgium: Flemish sector



The waterway Seine-Scheldt project includes the trajectory of the channeled Lys of Deûlémont to Deinze, the diversion canal of the Lys to the junction with the Canal Ghent-Ostend, the Ghent-Ostend to the confluence with the ring canal and the Noordervak of the ring canal to the lock of Evergem.⁵²

Source: Belconsulting N.V. (2005): Vervolgstudie Seine-Schelde / Rivier herstel Leie.

10.6. Methodology and remarks on CBA and project selection

In 1999 a Cost Benefit Analysis "Economische studie verbinding Seine-Schelde, Technum ESEG, 1999" was conducted in order to provide a clear picture if an upgrade of the Seine-Scheld could be realized. In 2005 Belconsulting conducted an update. Within the latter CBA four different project alternatives are compared, these will be outlined further in the analysis. One of the guidelines which have been used during the conduction of the CBA is the "Dutch Directives for the Waterways" - Nederlandse Richtlijnen Vaarwegen (Commissie Vaarwegbeheerders, 1999).

In the CBA for Seine-Scheldt the following effects are addressed:

- Direct effects: these are the direct costs (investment, maintenance) and revenues (financial + travel time) as a result of the implementation of the project.
- Indirect effects: changes in society that are not directly involved in the project, but arise due to the project (creation or geographical shift of employment or to attract foreign businesses).
- External effects: these are side effects of the project, such as environmental impacts (emissions, noise), effects on other infrastructure (congestion) and social aspects (safety).

From previous studies followed that project alternative 3 is preferred to the other project alternatives. Project alternative 3 scores the highest for both monetized- and non-monetized effects, environmental and landscape impacts and social impacts. The Cost Benefit Analysis shows that the project alternative 3 is the only alternative with a positive balance, so with a positive yield ratio.

The project selection is based on the previously conducted survey, the spatial development and the results of the working profile. The development consists of 15 plans with the spatial development of this development plan and a descriptive section with a motivation of the proposed interventions in each of these plans. This spatial effect is preceded by a summary of the design principles which may be used.⁵³

⁵² Belconsulting N.V. (2005): Vervolgstudie Seine-Schelde / Rivier herstel Leie, 13.

⁵³ Belconsulting N.V. (2005): Geïntegreerd Strategisch Plan. Opmaak van het ontwikkelingsplan, 118.

10.7. Methodology and remarks on environmental analysis

The available document is a summary of the conducted EIA ; this summary does not mention the followed guidelines. Furthermore no separate CIA was conducted. CO₂ emissions have been covered within the EIA. Besides the environmental aspects which have been taken into account are the following: Ground and water; Noise; Air; Human life; Fauna and Flora; Monuments and landscapes. There is no indication that certain relevant environmental aspects have not been addressed.

10.8. Characteristic of the transport demand scenario and its economic drivers

In 1999 a prospective study of traffic forecast has been conducted. In 2003 the Lys approximately counted 6.7 million tonnes transported goods which are nearly 22,000 cargo ships.

On this basis, a relationship between the development of the industrial production in Belgium and the growth of inland transport on the Lys has been made. This relationship is also being implemented in the autonomous growth of navigation on the river Lys, resulting in an annual growth of 1.4%. This increases the transport from 6.7 million tonnes in 2003 to 9.0 million tonnes in 2025.⁵⁴

Due to the fact that we had only a summary report of the by Belconsulting N.V. conducted CBA, EIA and transport demand forecasts, there was unfortunately no detailed description of the main governing assumptions. We have tried to get a hold on the original documents, which presumably contain this information, but the tight timetable did not allow us to receive them on time. The relevant original document is: "Actualisatie economische studie: trafiekprognose". Concerning this part of the project there are, as far as our research show us, no updates available on this Upper Schelde part. As we have seen in the analysis on the French part there are studies which conducted new transport scenario`s for the concerned area.

10.9. Investment cost and structure of financing

To have a better understanding of the total cost estimations it is important to have a clear overview of the different alternatives the project proposes. Unfortunately we have insufficient information on the financial engineering. The project is based on the following four project alternatives:

- Alternative 1, depth 4.0 m class Vb ship "Full two-way"
- Alternative 2, depth 3.5 m class Vb ship "Draft-limiting class Vb"
- Alternative 3, depth 3.5 m class Vb "Keep current waterline, tight profile Class IV / unidirectional class Vb"
- Alternative 4, depth 3.0 m class Vb ship "Profile Seine Nord".⁵⁵

The total cost of the project is largely determined by the cost of the processing of the ground mortar. Estimations were calculated for the minimum and maximum scenario for all alternatives. The following estimates (minimum, maximum and average) form the total cost of the Seine-Scheldt project.

⁵⁴ Belconsulting N.V. (2005): Geïntegreerd Strategisch Plan. Technische & Economische Analyse, 93.

⁵⁵ Belconsulting N.V. (2005): Geïntegreerd Strategisch Plan. Technische & Economische Analyse, 93.

Total cost estimation for the Flemish project component (EUR):

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Minimum total	353.308.449	288.715.936	176.669.122	321.760.403
Maximum total	446.285.609	353.222.832	213.031.107	401.959.419
Average total	399.797.029	320.969.384	194.850.114	361.859.911

The delays occurred on the French side have had an immediate effect on the Belgian developments just across the border due to necessary co-ordination. In particular on the sections concerning Lys and Pommeroeul-Condé, delays by the French partner have had a repercussion on these Walloon projects.

10.10. Cost developments over the life-cycle of the project

The investment costs were occasionally reviewed and adjusted. The first economic analysis study in 1999 calculated cost predictions, which were updated in 2005. However, there is no specific documentation available, although one can assume that at the time of the review, all new elements have been taken into account.

Appendix 1: Chronology

The 350-tonne capacity Saint-Quentin Canal, built in the 19th century, was the first to be studied in **1975**.

1978: studies began on the 650-tonne capacity Canal du Nord, initiated in the early 20th century and completed at the end of 1965.

1983-85: Studies led to the preparation of a waterways master plan in which priorities for inter-basin links were defined, including two options for the Seine-Nord link.

In **1989**, the Chassagne report urged France to join the European waterway system and recommended three scenarios, proposing the rehabilitation of the existing, out-dated network, construction of the Seine-Nord and Rhine-Rhône links to avoid losing a considerable amount of traffic to foreign networks, a reduction in transport costs and improvements in safety.

1990-1993: studies were carried out focusing mainly on the eastern option of the Canal. In the same year (1993) the Secretary of State for Transport decided that the Seine-Nord Europe Canal project would be submitted for public debate. The project was formally included in the planned trans-European high capacity waterway network.

1993-1994: Débat Publique (public hearings)

1996-1997: preliminary studies were carried out and were aimed in particular at identifying the routing path representing the optimum solution among 21 possible routing paths divided into three main groups: the first close to the existing Canal de Saint-Quentin, the second close to the existing Canal du Nord and the third covering the various intermediate solutions between the other two.

1999: The economic study "*Conseil général des Ponts and Chaussées*" concluded that the solution of a waterway of Class Vb on a new path (corridors 2A-EC-N3) was the only solution which guaranteed long-term efficiency.

2002: The path designated as N3, along the Canal du Nord, was adopted in March 2002 in recognition of its reduced cost and its lesser impact on the environment.

2004: Seine-Scheldt selected as an European priority project in TEN-T (PP 30)

2008: Declaration of Public Utility; Decision by EC to finance the project

2008 - 2009: Diagnostics archaeological studies and launch of the Invitation to Public Competition (ACPA) procedure for Public Private Partnership (PPP); start land acquisition

2009-2011: Phases of the competitive dialogue that will lead to the signing of the partnership agreement (CP)

2011: Seine-Scheldt included in the proposed European Core Network (Corridor n° 9 Amsterdam-Marseille)

2012: In France, the first quarter of 2012 was dedicated to the competitive dialogue with the two selected bidders on the basis of their provisional proposals sent in October 2011, including those for the technical, contractual and financial parts.

Appendix 2: Selected Bibliography

Year	Type	Title
2012	General	TEN-T EA (2012): The Seine-Scheldt inland waterway network - cross-border section between Compiègne and Ghent. Online : http://tentea.ec.europa.eu/en/ten-t_projects/ten-t_projects_by_country/multi_country/2007-eu-30010-p.htm (30.11.2012).
2012	General	European Commission (2012): Annual report of the Coordinator. Priority Projects 18 and 30. Karla Peijs
2006	Socio-Economic	VNF (2006a): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol H – Socio-economic assessment, December 2006
2006	Environment	VNF (2006b): Enquiry prior to Declaration of Public Interest. European Seine-Scheldt Waterway, Seine-Nord Europe Canal and related developments from Compiègne to Aubencheul-au-Bac, vol, F - Impact Study: Non-technical summary, December 2006.
2005	CBA/Traffic	Belconsulting N.V. (2005): Geïntegreerd Strategisch Plan. Technische & Economische Analyse
2005	General	Belconsulting N.V. (2005): Geïntegreerd Strategisch Plan. Opmaak van het ontwikkelingsplan

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ISBN 978-92-823-4078-3

doi: 10.2861/29236