Ex ante evaluation of the TEN-T Multi Annual Programme 2007-2013

Framework Contract for Ex-ante evaluations and Impact Assessments (TREN/A1/46-2005)

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Abstract

The proposal for the renewed Community multi-annual (MAP) TEN-T programme for the period 2007-2013 prepared by the Directorate General for Energy and Transport (DG TREN) requires to undergo an ex ante evaluation.. The ex ante evaluation has two objectives: (a) to provide factual support for the selection of projects, and (b) to start already preparing its mid-term review. The results of this evaluation are described in this report.

It is expected that concentrating the MAP TEN-T budget on completing the pan-European corridors, by a mix of cross-border and bottleneck projects situated on the predefined priority axes/projects ("Corridor concept"), will accelerate the overall implementation of the TEN-T. This, in turn, is expected to have a positive impact on the EU's economy as the benefits from having a more efficient transport system will occur sooner and these benefits outweigh the costs.. The Benefit Cost Ratio equals 1.6 which means that every Euro spent generates a socio-economic benefit of 1.6 euros to the EU+27.

Based on the calculations presented in this report, our conclusion is that the present MAP TEN-T budget for works in the period 2007-2013 is not enough to cover the actual estimated need in this period. A potential increase of the budget could be made contingent on the rate at which the current budget is expended. Such an increase will have a net positive socio-economic effect for the EU+27.

Executive Summary

Background and goal of the study

The Directorate General for Energy and Transport (DG TREN) designed and prepared a proposal for the renewed Community multi-annual Transport European Network Transport (TEN-T) programme for the period 2007-2013. This renewed multi-annual programme (MAP) TEN-T is required to undergo an ex ante evaluation. This report describes the results of this evaluation.

The primary objective of this study is to answer the following question - in what way can the relatively small (relative to other financing sources) budget of the MAP TEN-T make a speed -up the realisation of TEN-T while providing European Added Value.

Problem analysis

The problem analysis concentrates on aspects related to the realization of TEN-T projects. The major problems hindering the successful implementation of the TEN-T are listed below; these are to a large degree interrelated:

- Insufficient budget to complete the TEN-T within the originally foreseen time frame of 2020
- Poor project preparation and poor administrative and technical management by project promoters
- Inefficient, or lack of cross-border cooperation, due to conflicting national needs and the needs of the EU

The next figure provides a detailed overview of problems and their underlying causes. It shows that many of the identified causes of problems explain the slow pace of implementation of TEN-T projects.

The limited EU TEN-T budget for works poses budgetary constraints which are not resolved by the insufficient national funding. The lack of funding makes it necessary to seek private financing to realise the TEN-T projects, and this is difficult. Thus, the rate at which these projects are implemented is considerably slower than what it would be were sufficient funds to be available.

Poor project preparation and implementation is responsible for the poor quality of the feasibility studies, risk assessments, too little attention being paid to environmental impacts and insufficient public consultation. In some cases, the quality of the project management (implementation) is below the professionally acceptable quality standards.

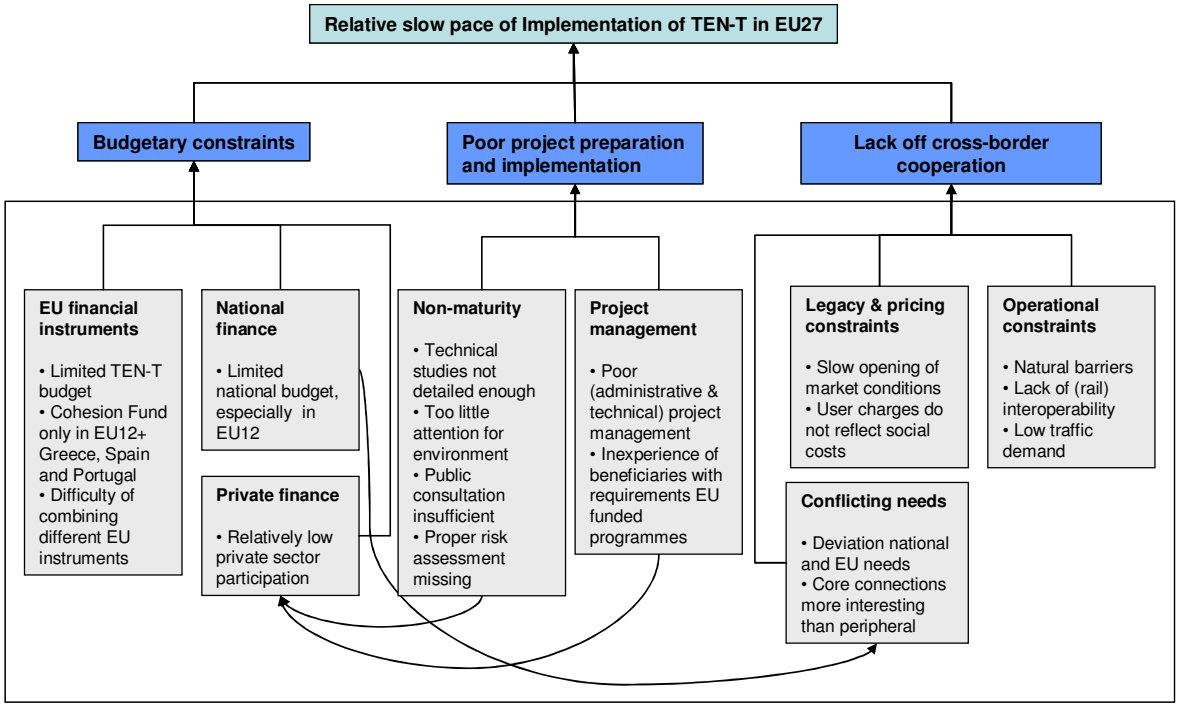


Figure E.1: Problem tree

The lack of cross border cooperation is mainly because of differences in EU and national needs. The European TEN-T axes do not always contribute sufficiently to a single country to outweigh the costs that this country has to bear. Not surprisingly, countries that do not benefit from the TEN-T projects are reluctant to invest in these projects. Natural barriers, lack of rail interoperability and low traffic demands further undermine cross border cooperation.

It should be noted that the contribution of the Commission, more specifically DG TREN, to solve these problems differs by problem. In some areas, like the project promoters' project management, the Commission's influence is limited. The Commission has a more visible role in trying to overcome budgetary constraints and promoting cross- border cooperation.

General, specific and operational objectives

Taking into account the objective of the revision of the Community guidelines as presented in the extended impact assessment (COM(2003)/645 final), the general objectives of the TEN-T policy are:

- To contribute to a sustainable transport system at European level by giving priority to investments in environmental friendly modes in view of rebalancing modal shares
- To further integrate transport networks of the EU+12 with those in the EU+15 and improve the quality of the networks in the EU+12 in order to reduce travel time, travel cost, accidents and environmental damage from transport
- To contribute to strengthening the EU's competitive position by improving the quality of the core transport network in the EU+27

The specific objectives of the MAP TEN-T are defined as:

- To speed-up the realisation of the TEN-T priority projects
- To improve the cost-effectiveness of the TEN-T financial means

Finally, the operational objectives are related to the concrete activities that result from the MAP TEN-T. It is expected that the intervention addresses the following operational objectives:

- To improve the quality of project preparation
- To improve coordination between countries
- To increase the sense of urgency regarding the realisation of the TEN-T projects
- To optimise the use of financial instruments, attracting financing from additional sources (PPP)

Results of the stakeholder consultation

The ex-ante evaluation contains a stakeholder consultation which focussed on three groups of stakeholders:

- TEN-T Coordinators (interviews)
- European organisations (interviews)
- Member States (questionnaires)

The most important findings from the stakeholder consultation are summarized below. Additional attention is given to the elements that were emphasized by all three groups of stakeholders.

Financial funds available

Stakeholders from all three groups made remarks about the available financial funds to financing the implementation of the TEN-T projects:

- The TEN-T budget is considered to be an important source of finance and the allocation of this budget to a project can accelerate its development by several years. However, the total TEN-T budget available is considered to be (too) small.
- The major source of finance for TEN-T projects is national funding (and Structural and Cohesion Funds in beneficiary countries)
- Public Private Partnerships (PPPs) could play an important role in realising TENT-T project. However, creating the right set of conditions for successfully using PPPs to finance TEN-T projects remains difficult.
- There is no optimal mix of financing from different sources to realise TEN-T projects. The suitability of using finances from different sources depends, among other things, on the specific character of the project.

Problem analysis

Two major problems hindering the implementation of the TEN-T projects were identified by all three groups in the stakeholder consultation.

- The sum total of available funds (TEN-T budget, Structural and Cohesion Funds, Loans of the EIB, National Funding, PPP) is not enough to realize the TEN-T in line with the original planning.
- There exist major difficulties in coordinating cross-border project which are caused, among other things, by conflicting priorities at EU and national level – and even between Member States. These conflicting needs are also limiting the amount of national funding awarded to certain TEN-T projects.

Solution to the problems

To solve these problems a number of solutions were proposed. The most often quoted solutions were:

- Prioritization of the TEN-T budget. The limited budget and administrative capacity should be allocated towards the most important projects: those that will eliminate major bottlenecks and cross border projects. It was suggested that these projects should also be awarded higher co-financing rates in an attempt to convince Member States to reserve (higher) more national funds for these priority projects. The TEN-T programme management can play an active role in the prioritisation of the (MAP) TEN-T budget.
- Simplification of administrative procedures and increasing the flexibility of using different (European) financial funds were also raised. No information on proposals for the simplification was collected; this remark was considered to be too general and not very useful for this study[1]. Greater flexibility in using different EU funds is considered unrealistic because of the procedures described in the financial regulation.
- Improving (cross-border) coordination. The Commission should provide guidance and support to actors involved in TEN-T projects, especially on the coordination work involved in cross-border projects. The Member States on the other hand should (formally) commit themselves to the completion of these projects within a certain timeframe. This would include formalizing their willingness to participate in cross border cooperation and to contribute financially. The European coordinators can contact and stimulate partners outside of the official procedures, but also point them on their official obligations.

Policy Options

The problem tree gives rise to a several elements to be studied in more detail to assess the composition of the MAP TEN-T in order to contribute to increasing the speed of realisation of the TEN-T.

Budgetary constraints and cross-border cooperation: concentrated support

Although the MAP TEN-T budget is limited, it could be used as a catalyst to accelerate the implementation of transport projects of European interest. One type of concentrated support is to mitigate the problems related to budgetary constraints and (partly) lack of cross-border cooperation. The concentration of support is possible in different fields, for example, co-funding only cross border projects.

[1] The ex-post evaluation of the MAP TEN-T 2000-2006 (scheduled to be finalised in October 2007) is likely to present a detailed analysis of the administrative procedures and potential simplifications.

The policy options that have been identified for further research focus on providing concentrated MAP TEN-T support:

- **Option 1 "Corridor concept"**: Co-funding a mix of cross-border and bottleneck projects situated on the predefined priority axes/projects[2].
- **Option 2 "Cross-border focus"**: Co-funding only a set of cross-border projects situated on the priority axes/projects. This includes Motorways of the Sea projects.
- **Option 3 "Bottleneck focus"**: Co-funding only a set of bottleneck projects situated on the priority axes/projects.
- **Option 4 "European Added Value"**: Co-funding a set of projects of high European Value Added situated on the priority axes/projects.

Each of the policy options has been substantiated in terms of the infrastructural projects to be included. The selection procedure uses pragmatic and realistic criteria[3] in a Multi-Criteria Analysis to identify projects with a significant chance of receiving financial support from the TEN-T budget.

Budget available for works

The total amount available for grants on the basis of the multi-annual work programme in the field of TEN-T ranges from € 6.4 billion to € 6.8 billion for the period 2007-2013. The indicative amount for the priority projects including Motorways of the Sea (€ 310 million) and excluding horizontal priorities (€ 1.2 billion) and Galileo (€ 190 million) is between **€ 5.0 billion and € 5.4 billion**[4].

The following assumptions have been made regarding the allocation of the MAP TEN-T budget:

- 10% of the budget is allocated to studies (of which up to 50% co-finance)
- 90% of the budget is allocated to works, of which
  - maximum of 20% co-financing in priority projects;
  - maximum of 30% co-financing in cross-border projects and natural barriers in priority projects;
  - maximum of 10% co-financing in other projects.

When applying the 10% share for studies, this results in a total amount of between **€ 4.5 billion and € 4.9 billion** available for construction of infrastructure. The upper limit of € 4.9 billion is used for the selection of projects. It is assumed that the 10% share for studies is directly linked to the projects selected for works in the policy options.

Each policy option consists of a **maximum** and **minimum** scenario which relates to the overall number of projects in the specific option. In the "minimum number of projects" scenario, the maximum co-financing rates per type of project apply which results in a relatively low number of projects. In the "maximum number of projects" scenario the co-

[2] The priority projects and axes have been identified in the High Level Group headed by Mr van Miert.

[3] Ideally the criteria to be applied should be in line with the criteria applied in the High Level Groups. However, these criteria are not known to the consultants.

[4] DG TREN Presentation "TEN-T Financial Assistance Committee, Brussels, 2 March 2007".

financing rate is only assumed to be half of the maximum rate, which results in a set of additional projects in the option compared with the minimum scenario.

Speeding-up element

One of the key questions to be answered in this evaluation is whether (a type of) focussed TEN-T support, to be operationalised by the above mentioned policy options, could speed-up the realisation of the total TEN-T network.

The High Level Group[5] considers that the label of "priority project," leading to the coordination and concentration of Community financial resources, must also lead to increased financial contributions of the States and local authorities allocated to the trans-European transport network. This label must also serve as a reference for the loan policy of the European Investment Bank. The Group also thinks that this label, in the presence of suitable legal structures, will help to attract private investors. Increased funds should lead to a speeding-up the realisation of these projects.

Different sources of information[6] have been studied to gather evidence on the potential impact of the availability of sufficient financial resources on the speed of implementation of transport infrastructure projects. The typical delay in implementation is 1-2 yrs; however, in 30% of the cases the delay is longer than 2 years. It proved to be impossible, however, to isolate the contribution of the financial factors to these delays relative to other factors such as poor project preparation, lack of (cross national) cooperation etc. We assumed that by assuring sufficient financial resources, the implementation of the infrastructure could be sped up by between 0 and 20 years. The latter acceleration (20 years) could occur in case of a cross-border project for which the Member States involved do not show any interest. Then, a significant EU financial grant could actually lead to much quicker implementation of the project.

During the stakeholder consultation this acceleration effect was also discussed. The stakeholder consultation gave rise to the following assumptions about acceleration effects:

- Cross-border projects will on average be realised **3 years** earlier in case the available TEN-T budget is at least 30% of the eligible construction costs
- For projects to solve bottleneck, the average speeding-up is assumed to be **2 years**, because these sections are, according to the definition used in this study, situated on the territory of only one Member State. The national interests are larger compared to cross-border projects and thus it will be easier to engage national budgets.
- The wider time gains for the whole corridor are estimated to be somewhat less compared to the figures for the specific sections: only **1 year**.

It is assumed that projects which have not been selected in the policy options, still will be implemented, but will not be speed up.

[5] Final report of the High level group on the Trans-European Transport network (2003).

[6] E.g. “Megaprojects and risk, An anatomy of ambition”, B. Flyvbjerg 2003, ISBN 0521009464, “”Ex-post evaluation of a sample of projects co-financed by the Cohesion Fund in 1994-2002”’on behalf of DG Regional Policy, 2004, ECORYS

Analysis of impacts

The analysis of impacts of the policy options is based on desk research and the stakeholder consultation. Most impacts are determined using existing sources. An additional modelling exercise using the SASI model[7] was carried out to assess macro-economic (GDP growth) and territorial cohesion impacts.

The policy options are compared and ranked on each separate impact criteria (4=best option, 3=second best, etc.). The impact criteria are grouped into economic, environmental and social impact categories. In the following two tables the ranking of the policy options are presented per impact category, as well as an overall score per policy option (= base case):

Table E.1 Base case: Ranking of TEN-T policy options (**minimum** number of projects) (highest figure=best score)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
Economic impacts	40	38	27	38
Environmental impacts	9	11	6	4
Social impacts	7	5	5	4
TOTAL SCORE	**56**	**54**	**38**	**46**
European Added Value Average international rail and road speed	3	4	1	2

Table E.2 Base case: Ranking of TEN-T policy options (**maximum** number of projects) (highest figure=best score)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
Economic impacts	46	27	24	44
Environmental impacts	11	7	3	9
Social impacts	6	3	4	7
TOTAL SCORE	**63**	**37**	**31**	**60**
European Added Value Average international rail and road speed	4	2	1	3

Table E.1 shows that in the minimum scenarios, the Corridor option scores the best, followed closely by the Cross-border option. The European Added Value option scores third and the Bottleneck option is the least preferred option.

In the maximum scenarios, the Corridor option is again the best option. The second best is the European Added Value option. Clearly this option scores better than the Cross-border and Bottleneck option, it comes even close to the first ranked.

Based on both tables, it is clear that the Corridor option is the best option.

[7] The SASI model is a recursive-dynamic simulation model of socio-economic development of 1330 regions in Europe. The model was developed to assess socio-economic and spatial impacts of transport infrastructure investment and transport system improvements. It has been applied and validated in several large EU projects including the IASON and ESPON projects

Sensitivity Analysis

A sensitivity analysis was performed regarding the acceleration effects. The following variations were analysed:

- Cross-border projects will on average be realised **5 years** earlier (instead of 3);
- Bottleneck sections will on average be realised **1 year** earlier (instead of 2);

The result of the sensitivity analysis for the ranking of the policy options is listed in the next two tables.

Table E.3 Ranking of TEN-T policy options after increasing the acceleration to 5/1 year(s) (**minimum** number of projects) (highest figure=best score in *italics* the difference with the base case)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
SENSITIVITY CASE				
Economic impacts	40 *(0)*	44 *(+6)*	21 *(-6)*	39 *(+1)*
Environmental impacts	10 *(+1)*	11 *(0)*	4 *(-2)*	5 *(+1)*
Social impacts	7 *(0)*	6 *(+1)*	3 *(-2)*	5 *(+1)*
TOTAL SCORE	**57 *(+1)***	**61 *(+7)***	**28 *(-10)***	**49 *(+3)***

The observation from the above table is that the Cross-border option gains the most and consequently also scores as the best option. This is however not a surprise since all projects in this option are accelerated, whereas for the other options only part (or no) projects are realised earlier. The higher score is almost completely on the expense of the Bottleneck option which scores less well. The other two options remain stable.

The results of the sensitivity analysis for the maximum (number of projects) scenarios are shown in the following table.

Table E.4 Ranking of TEN-T policy options after increasing the acceleration to 5/1 year(s) (**maximum** number of projects) highest figure=best score in *italics* the difference with the base case)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
SENSITIVITY CASE				
Economic impacts	48 *(+2)*	32 *(+5)*	20 *(-4)*	42 *(+1)*
Environmental impacts	11 *(0)*	8 *(+1)*	3 *(0)*	8 *(-1)*
Social impacts	7 *(1)*	4 *(+1)*	2 *(-2)*	7 *(0)*
TOTAL SCORE	**66 *(+3)***	**44 *(+7)***	**25 *(-6)***	**57 *(-3)***

The increase of acceleration (sensitivity analysis) for the maximum scenarios shows that the Corridor option remains the best option followed by the European Added Value option. The ranking of options is the same compared to the base case situation.

The sensitivity analysis shows that the ranking of the options is sensitive to the assumption about the average acceleration effects in the minimum scenarios only.

It is concluded that in general the Corridor option is the most favourable option.

Cost-Benefit Analysis

The ranking of policy options, according to the above Multi-Criteria Analysis (MCA), is complemented with a (partial) socio-economic Cost-Benefit Analysis (CBA) in accordance with the EC Guidelines on conducting CBAs[8]. The present CBA analyses the impacts of the policy options on EU+27 level.

The costs (or capital expenditures) to be financed from the MAP TEN-T of the Corridor policy option amount to € 4,839 million. This amount is spent on the projects included in the option, on average, 3 years earlier (acceleration effect) compared to the situation without the MAP TEN-T (reference scenario).

It should be mentioned that the substantial amount of additional investment (from national sources, loans and PPP's) equal to € 16,234 million is also needed to actually realise these projects earlier.

This policy option includes an acceleration effect, which means that the costs for the construction of the projects are made earlier in time compared to the situation without the MAP TEN-T. The net capital expenditures are thus composed of interest costs, since in the reference situation the money is spent 3 years later in which interest is received. The net capital expenditures are equal to **€ 2,372 million** (Present Value).

The Benefits, in Net Present Values are as follows:

- Time savings passengers € 1,980 million
- Cost savings freight transport € 337 million
- Cost savings due to reduction of road congestion € 257 million
- Reduction of NOx emission € 9 million
- Reduction of CO_2 emission € 237 million
- Reduction of particulates emission € 1 million
- Improvement of traffic safety € 307 million
- Indirect economic impacts € 772 million

The total (rounded) Benefits amount to **€ 3,900 million** (Present Value)

Internal Rate of Return and Benefit Cost Ratio

The result of the CBA is expressed in an Internal Rate of Return (IRR) and the Benefit Cost Ratio. The IRR is equal to **7.4%** which convincingly outweighs the required threshold being the social discount rate of 5%[9] representing a risk free interest rate to be received in case no investment is done. This means that from a socio-economic point-of-view this policy option is feasible. The Benefit Cost Ratio equals **1.6** which means that each Euro spent generates 1.6 Euro socio-economic benefits to the EU+27 consisting of travel time savings, transport cost reductions and reduction of pollution.

[8] Guide to Cost-Benefit Analysis of investment projects, Evaluation Unit DG Regional Policy European Commission, 2002
[9] Ibid

Quantification of programme budget

It is noted that in the definition of policy options, a total amount of € 6.4 to € 6.8 billion has been used for the MAP TEN-T budget for the period 2007-2013. The actual financial need to implement all priority projects is however much higher. This meant that only a limited number of priority projects have been included in the policy options.

In the framework of this ex-ante evaluation an independent estimation of the MAP TEN-T budget needed until 2020 has been carried out. The analysis is based on the most recent information on progress and cost of the TEN-T network, which was has also been used in our selection of project in the policy options. The following assumptions are made:

- The maximum co-financing rates according to the Financial Regulation are applied[10]
- The calculation is based on the costs estimated in the most recent TEN implementation report (2005)
- The calculation only focuses on works on the TEN priority projects, excluding horizontal actions, Galileo and other TEN projects, but including projects in all Cohesion Fund countries
- The distribution of costs is supposed to be linear in time for all projects
- Cost information is missing on a couple of projects; therefore no costs could be considered for these projects

It is estimated that in total € 21.3 billion is needed for works in the period 2007-2013 and an additional € 15.8 billion in the period 2013-2020 for all priority projects to be financed from the MAP. The estimated other sources of finance (national budgets, Cohesion Fund, loans and PPPs) would need to be at least € 86.7 billion for the priority projects in the period 2007-2013 and an additional € 60.6 billion for the period 2013-2020.

The aforementioned financial calculations add up to a total of € 184.4 billion for works on all priority projects (except horizontal actions and Galileo) until 2020. This is less than the € 252 billion mentioned in DG TREN information. This is due to several reasons:

- Incomplete cost information
- No provision taken into account for necessary studies

Prerequisites for successful spending

The above estimated amounts of finance needed have been calculated in a rather mechanical way without consideration of other prerequisites to realise the TEN-T network. Besides the budgetary constraints, there are basically two other main reasons for the rather slow speed of implementation of the TEN-T network to date:

- A lack of or inefficient cross-border cooperation
- Poor project preparation and poor administrative and technical management

The lack of well established cross border cooperation is amongst others due to conflicting EU and national needs. Bringing in additional EU funds is only part of the solution, since Member States will be required to co-finance (in most case) the majority of the projects.

[10] 20% co-financing in priority projects; 30% co-financing in cross-border projects and natural barriers; 10% co-financing in other projects.

Therefore, it remains important to seek for common interests in any TEN-T priority project. The formal willingness for cooperation between Member States could for instance be laid down in Memoranda of Understanding and cross border project organisations.

The European Coordinators have already proven to be instrumental in putting projects forward, by means of bringing the key stakeholders together and actively searching for common interests. With increasing budgets, it is recommended to further strengthen the role of the Coordinators.

Clearly, the focus of the MAP TEN-T is on realising projects by financing works; only a minor part of the budget is to be used for project preparation studies. The impact of high quality technical, economic, financial and environmental feasibility studies should not be underestimated. If a project is well prepared (major) delays in the actual implementation could be avoided. Secondly, better project design, implementation and management is likely to lead to an increase in private investment (PPP). If more bankable projects are available, it is likely that the investment from private investors will increase.

Conclusions

The support through a MAP for the priority TEN-T projects provides added value in terms of realisation of projects. In particular cross-border projects face difficulties in terms of allocation of enough national funding to make these projects happen. The support from the Commission is therefore welcomed and it is recommended to continue this support.

Through concentrating the MAP TEN-T budget on completing pan-European corridors by a mix of cross-border and bottleneck projects situated on the predefined priority axes/projects ("Corridor concept"), it is expected that the overall implementation of the TEN-T will be accelerated compared to a more scattered allocation of resources. This acceleration has a net positive impact on the EU's economy since benefits from a more efficient transport system will occur earlier in time and these benefits outweigh the costs. The rate of return of the Corridor concept is equal to 7.4% which convincingly outweighs the social discount rate of 5% meaning that, from a socio-economic point-of-view, this option is feasible. The Benefit Cost Ratio equals 1.6 which means that each Euro spent generates € 1.6 socio-economic benefits to the EU+27.

Based on the calculations it is concluded that the present MAP TEN-T budget for works in the period 2007-2013 is not enough as compared to the actual estimated need in this period. A potential increase of the budget could be made dependent on the speed of absorption of the present budget. Such an increase will have a net positive socio-economic effect for the EU+27.

Recommendations Commission level

Aim for concentrated MAP TEN-T support

It is advised to concentrate the limited MAP TEN-T budget for the period 2007-2013 on completing (cross-border and bottleneck) sections of main corridors ("Corridor concept") situated on the priority projects. This approach will provide added value compared to a more scattered allocation of resources. The TEN-T Executive Agency should play an active role in ensuring the concentrated support.

Create political support amongst Member States

If concentrated support were to be applied, this directly means that not all countries will be served equally in terms of financial support from the MAP. It is expected that such a choice will lead to (some) resistance amongst Member States. Therefore, it is recommended to actively invest in creating acceptance from Member States, through for example highlighting the accomplishments by use of best practice examples of cross-border projects and corridor completion. The Commission should in our view continue to support the valuable work of the European Coordinators.

Monitor and evaluate the speed of implementation

The speed of implementation of projects in the 2007-2013 period should be monitored in order also to understand better the relation between concentrated support and acceleration. More effort should be devoted to the systematic collection of empirical information on reasons for delay of projects.

Importance of EIB as core partner

A close collaboration with the EIB is deemed necessary to encourage the selection of mature TEN-T projects for finance and subsequent implementation. It is recommended that the EIB actively promotes the Loan Guarantee Scheme in order to stimulate PPPs. This is a promising instrument for bridging the financial gap that exists between the actual needs and the available funds for the completion of the whole TEN-T priority project network.

Prerequisite for potential MAP TEN-T budget increase

Based on our calculations it is clear that the present MAP TEN-T budget for works in the period 2007-2013 is not enough as compared to the actual need in this period. A potential increase of the budget could in our view be made dependent on the speed of absorption of the present budget.

Need for comparable study addressing Cohesion Fund countries

The present ex-ante evaluation, for the purpose of the study, mainly looked at the countries which are not eligible for the Cohesion Fund. It is recommended to assess also the economic, environmental and social impacts of forms of concentrated support of the Cohesion Fund.

Recommendations Member State level

Improve project preparation, implementation and management

It is generally acknowledged that project preparation, implementation and management of large transport projects could be (substantially) improved in order to decrease delays. This is also relevant for TEN-T projects. Project promoters in the Member States are thus advised to invest in improving these elements. It should be noted that part of the MAP TEN-T budget could be spent on studies, thus helping improving project preparation.

Formalise willingness to cooperate on cross-border projects

There is a need to try to ensure that cross-border TEN-T projects will continue to get (political and financial) support from the respective Member States after change of (key) decision makers. This is already made effected through Memoranda of Understanding and the set-up of cross-border project organisations which is obligatory for financially divided cross-border projects according to the TEN-T Guidelines.

1 Introduction

1.1 Background

Since the end of the 1980s, the European Union has developed the idea of Trans-European Networks (TENs). Obviously freedom of movement for goods, persons and services is only possible if the various regions and national networks making up the single market are properly linked by modern and efficient infrastructure. The construction of a Trans-European Transport Network (TEN-T) is an important element for economic growth and the creation of employment.

The TEN policy was included in the Treaty in 1993, providing it a sound legal basis. Under the terms of the Treaty[11], the EU must aim to promote the development of TENs as a key element for the creation of the internal market and the reinforcement of economic and social cohesion. This development includes the interconnection and interoperability of national networks as well as access to such networks.

The TEN Community guidelines were adopted in 1996 (Decision No 1692/96), aiming at integrating national networks and modes of transport, linking peripheral regions of the Union to the centre and improving safety and efficiency of the networks. In 2001 a revision of the guidelines took place (Decision 1346/2001/EC), to include seaports, inland ports and intermodal terminals. In this first revision also the characteristics and criteria for specific projects and projects of common interest were identified.

As part of a broader review of these Community guidelines, a High-Level Group[12] identified the 30 priority projects of the TEN-T up to 2020[13] on the basis of proposals from the 25 Member States and the former accession countries Bulgaria and Romania. The priority projects only include: *"the most important infrastructures for international traffic, bearing in mind the general objectives of the cohesion of the continent of Europe, modal balance, interoperability and the reduction of bottlenecks"*.

In September 2001 the "multi-annual indicative programme 2001-2006" (MIP) was introduced. The objective of the MIP was to secure smooth and timely financing for major projects (including the Essen priority projects and Galileo) on a multi-annual basis. The MIP was intended to functions as a planning instrument and was introduced in order to recognize and deal with the longer-term nature of TEN-T projects by providing a framework in which the decisions can be made form the allocation of the TEN-T budget.

[11] Chapter XV, Articles 154, 155 and 156
[12] Chaired by Mr. Karel van Miert
[13] Decision 884/2004/EC of 29 April 2004

This way, Member States are given an indication of the likely allocation of funds over a period of several years, in advance.

A renewed Community "multi-annual indicative TEN-T programme (MAP) for the period 2007-2013", which is based on the new TEN-T Regulation 2007-2013, has been proposed by the Commission on 14 July 2004 (COM(2004)475) and then modified by the Commission on 25 May 2006 (COM(2006)245).

1.2 Study purpose

The renewed Community multi annual programme (MAP) TEN-T 2007-2013 is required to undergo an ex ante evaluation according to Article 27 of the Financial Regulation.

The ex-ante evaluation will analyse the available policy options and their different impacts, measure and compare impacts with relevant and credible indicators, assess the risk and uncertainty of the assumptions and provide a Cost-Benefit Analysis of the intervention.

1.3 Study focus

This study needs to assess whether there are sound arguments for the budget allocation to the TEN-T programme for the period 2007-2013. One of the key questions is whether a focussed approach, e.g. on cross-border projects and bottlenecks, will lead to a faster realisation of the network and a higher European added value compared to other options. The other Community (Cohesion Fund, EIB loans) and private (PPP) sources of finance available need to form an integral part of the analysis.

1.4 Structure of the report

This report is structured following the European Commission guidelines on conducting an Impact Assessment:

- The problem definition is described in chapter 2.
- Chapter 3 presents the objectives and indicators.
- The stakeholder analysis is described in chapter 4.
- The policy options are defined and elaborated in chapter 5.
- In chapter 6, an analysis of the impacts of each option is described including a comparison of options.
- Following that, chapter 7 presents the financial quantification.
- Future monitoring and evaluation is described in chapter 8.
- Finally, chapter 9 presents the recommendations.

2 Problem analysis

2.1 Introduction

The aim of this chapter is to provide a comprehensive analysis of the background against which the multi-annual programme (MAP) TEN-T has been designed. This will lead to the identification of key problems to be tackled.

The problem analysis concerns two major elements:

- The link between the problems in EU+27 to be faced in future because of expected traffic growth levels (e.g. impact on congestion, safety and cohesion) and the objectives of the TEN-T policy as mentioned in the Community guidelines. See sections 2.2 and 2.3.
- The aspects related to the realization of TEN-T projects (e.g. lack of cooperation between partner countries, delays due to poor project preparation). See section 2.4 and further.

It should be understood that this ex-ante evaluation is focussing on the second element; namely the actual implementation barriers. The MAP TEN-T should be designed in such a way to contribute to overcoming these problems.

Ideally the analysis of the realization of TEN-T projects should be completely aimed at projects co-funded under the previous multi annual indicative programme (MIP) TEN-T 2000-2006. This requires the results of an ex-post evaluation study of that specific programme which are scheduled to be available in October 2007. Therefore, and in order not to duplicate work, part of the implementation problems raised in this chapter are related to large transport infrastructure projects in general and not in particular on the TEN-T projects co-funded by the MIP TEN-T 2000-2006. This information is complemented with reports on the progress on the implementation of the TEN-T.

As a consequence, the problem analysis does not contain an assessment of implementation problems that could (partly) be mitigated through potential changes in the management of the MIP TEN-T by the Commission[14].

At the implementation level a SWOT analysis and problem tree have been developed as tools to show how the implementation problems relate to the wider objectives of a sustainable transport system.

[14] Such assessment is expected to be performed in the framework of the ex-post evaluation MIP TEN-T 2000-2006

2.2 Future performance of the European transport sector

The assessment of the future performance of the transport sector in the EU+27 relies on existing sources. The most important sources are the studies on "Scenarios, Traffic Forecasts, and Analyses of Corridors on the Trans-European Transport (TEN-STAC)"[15], "Trends to 2030 (European Energy and Transport – update 2005)" and the "SCENES[16]" project. The final results from the "TRANS-TOOLS"[17] project were not available in time for this study and were can thus not included.

2.2.1 Freight transport

The TEN-STAC study estimates that rapid growth until 2020 in trade flows and freight transport will continue. The highest growth in trade and transport is foreseen to take place between the (old) EU+15 and the newly entered countries in 2004 and 2007 (EU+12) and between the EU+27 and the neighbouring countries including Turkey and Russia.

Some other important information provided by TEN-STAC and used in the extended Impact Assessment study of 2003[18] illustrates:

- The volume of inter-regional land freight traffic measured in ton km is expected to grow by 70% between 2000 and 2020 in the EU+15 and as high as 95% in the countries entered in 2004 (EU10)
- International traffic (+95%) grows significantly faster than domestic traffic (+62%)
- The growth in trade is likely to further strengthen the dominant role of road haulage; the modal share of road freight will increase in acceding countries

The *Trends to 2030* report (update 2005)[19] shows more recent figures on freight transport development:

- Freight transport (measured in tonne-kilometres) in the EU+27 is expected to grow with 43% between 2005 and 2025.
- Growth in the EU+15 measures 35% in the period 2005-2025 and even 69% in the New Member States (NMS) entered in 2004. Freight transport in Bulgaria and Romania (members since 1-1-2007) is expected to increase spectacularly by 141% and 123% respectively in the period 2005-2025.
- The share of road transport in the EU+27 is expected to increase from 71% in 2005 (69.2% in 2000) to 76.7% in 2025. Particularly in the ten New Member States (NMS) entered in 2004, the road share will increase substantially from 63% in 2005 (58% in 2000) to 75.3% in 2025. In Bulgaria the share of road transport in 2025 is believed to arrive at approximately 80% (currently 67.2%), which is even higher than in the EU+15 or NMS. In Romania the share of road transport is expected to increase significantly as well to 75.3% in 2025 (currently 60.7%).

[15] This study has been concluded in 2004. DG TREN is in the process of commissioning an update of these forecasts taking into account the most recent developments, especially the entry of Romania and Bulgaria to the EU.

[16] Project co-funded by the European 4th Framework Programme for Research and Development with the aim to produce transport demand scenarios for the EU for 2020 and beyond

[17] Project co-funded by the European 6th Framework Programme for Research and aims to produce a European transport network model covering both passengers and freight, as well as intermodal transport, which overcomes the shortcomings of current European transport network models.

[18] COM(2003)564 final

[19] European Energy and Transport, Trends to 2030 – update 2005, European Commission, 22 May 2006.

In order to provide a complete overview the results of the earlier conducted SCENES project (final report April 2002) are also presented. It provides forecasts for intra EU+15 transport and between the EU+15 and the central and eastern European countries and includes freight transport by road, rail, inland waterways and maritime shipping. The results are as follows:

- Intra EU+15 transport (measured in tonnes lifted) is expected to increase by 28% in the period 1995-2020, with national transport within the EU+15 at 23% and international transport within the EU+15 at 89%.
- Transport between the EU+15 and the central and eastern European countries is expected to increase by more than 130% in the period 1995-2025.
- The share of road transport in national transport measured 92.4% in 1995. In the base forecast scenario it is expected to arrive at 94.1% in 2020. In international transport in the EU+15 the share of road measured 45% in 1995. In the base forecast scenario it is expected to arrive at 59% in 2020.

The most important figures on expected growth of freight transport are presented in the following table. The detailed SCENES figures are not presented since these are outdated compared to TEN-STAC and Trends to 2030 the other sources[20].

Table 2.1 Expected growth rate in freight transport (road, rail, inland navigation), based on tonne-kilometres

	TEN-STAC 2000-2020	Trends to 2030 2005-2025	Trends to 2030 2005-2030
EU+27	47%	43%	52%
EU+15	36%	35%	42%
NMS entered 2004	82%	69%	81%
Bulgaria	204%	141%	182%
Romania	248%	123%	163%

Source: *TEN-STAC* and *Trends to 2030*, European Commission; modified by ECORYS

The most important figures on the modal split in freight transport are presented in the following table.

Table 2.2 Development in modal split (based on tonne-kilometres) in %

	2005	2020	2025	2030
EU+27	**100,0%**	**100.0%**	**100.0%**	**100.0%**
• Truck	71,0%	75.7%	76.7%	77.5%
• Rail	17,0%	13.9%	13.3%	12.8%
• Inland navigation	11,9%	10.3%	10.0%	9.7%
EU+15	**100.0%**	**100.0%**	**100.0%**	**100.0%**
• Truck	72.9%	76.2%	77.0%	77.7%
• Rail	13.1%	11.3%	10.8%	10.4%
• Inland navigation	14.0%	12.5%	12.2%	11.9%

[20] Moreover, the SCENES results are provided in 'tonnes-lifted' and the other sources provide freight performance in "tonne-kilometres".

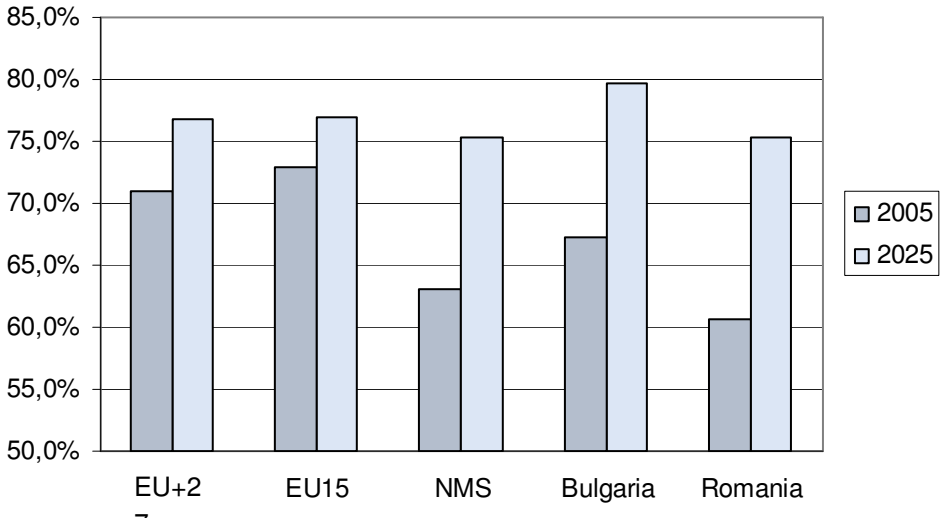
	2005	2020	2025	2030

Source: *Trends to 2030*, European Commission; modified by ECORYS for the years 2020, 2025 and 2030

Note: If EU25 is considered, the share of road transport in 2005 is 72.6% (Source: *Eurostat Statistical Pocketbook 2006, EU Energy and Transport in Figures)*

As visible in the previous table the share of road freight transport is expected to increase at the cost of transport by rail and inland waterways. Particularly in the new Member States, the countries entered in 2004 and 2007, the share of road will increase considerably to comparable or even higher levels than in the EU+15 (see next figure).

Figure 2.1 Modal split: share of road in total freight transport (based on tonne-kilometres)



Source: *Trends to 2030*, European Commission; modified by ECORYS

2.2.2 Passenger transport

The development of passenger transport in the EU+27 to 2020 is characterised by the following trends:

- A slow population growth
- The car ownership is expected to increase to Western-European levels in the EU+12
- An increase of congestion in cities
- A potential decline in public transport (bus, tram, metro and light rail) in the new Member States (entered in 2004 and 2007) in response to car ownership growth.
- Concerns over fuel dependency for car and aviation, especially with developing environmental issues that could constrain forecasted growth levels

The *Trends to 2030* report (update 2005)[21] shows recent figures on passenger transport development:

[21] European Energy and Transport, Trends to 2030 – update 2005, European Commission, 22 May 2006.

- Passenger transport (measured in passenger-kilometres) in the EU+27 will grow with 34% between 2005 and 2025.
- Growth in the EU+15 measures 30% in the period 2005-2025, and even 53% in the NMS entered in 2004.
- Passenger transport in Bulgaria and Romania is expected to increase spectacularly by 73% and 139% respectively in the period 2005-2025.
- The share of road passenger transport by private cars in the EU+27 is expected to increase from 77.6% in 2005 (77.5% in 2000) to 78.2% in 2025. Particularly in the ten NMS entered in 2004, road share will increase substantially from 73% in 2005 (58% in 2000) to almost 82% in 2025. In Bulgaria share of road transport in 2025 is believed to arrive at approximately 74% (currently 57.6%). In Romania the share of road transport is expected to increase significantly as well to 80% in 2025 (currently 76%).

The SCENES final report (April 2002) provides forecasts for intra EU+15 transport and domestic passenger travel in the central and eastern European countries. It includes passenger transport (measured in person-kilometres) by car, bus/coach and train:

- The forecasts of total volume of person-km travelled (EU+15 domestic and international) range from an increase of 30% and 54% between 1995 and 2020 depending on the Scenario adopted.
- The forecasts for total domestic passenger transport (person-km) in the central and eastern European countries diverges a lot depending on the country; Poland has the highest growth of person-km travelled with 115%, but also person-km travelled in Hungary (78%) and Lithuania (85%) are expected to increase sharply between 1995 and 2025, whereas Latvia shows a modest growth (21%).
- The share of road transport by cars (share on total number of trips in EU+15 and the central and eastern European countries) is expected to increase from around 56% in 1995 to 62% or even 67% in 2025 (depending on the scenario).

The most important figures on expected growth of passenger transport are presented in the following table.

Table 2.3 Expected growth in passenger transport (public road, private cars/motor cycles, rail, aviation and inland navigation), based on passenger-kilometres

	TEN-STAC 2000-2020	Trends to 2030 2005-2025	Trends to 2030 2005-2030
EU+27	37%	34%	40%
EU+15	33%	30%	35%
NMS entered 2004	61%	53%	66%
Bulgaria	81%	73%	89%
Romania	133%	139%	177%

Source: *TEN-STAC* and *Trends to 2030*, European Commission; modified by ECORYS

The most important figures on the modal split in passenger transport are presented in the following table.

Table 2.4 Development in modal split (based on passenger-kilometres) in %

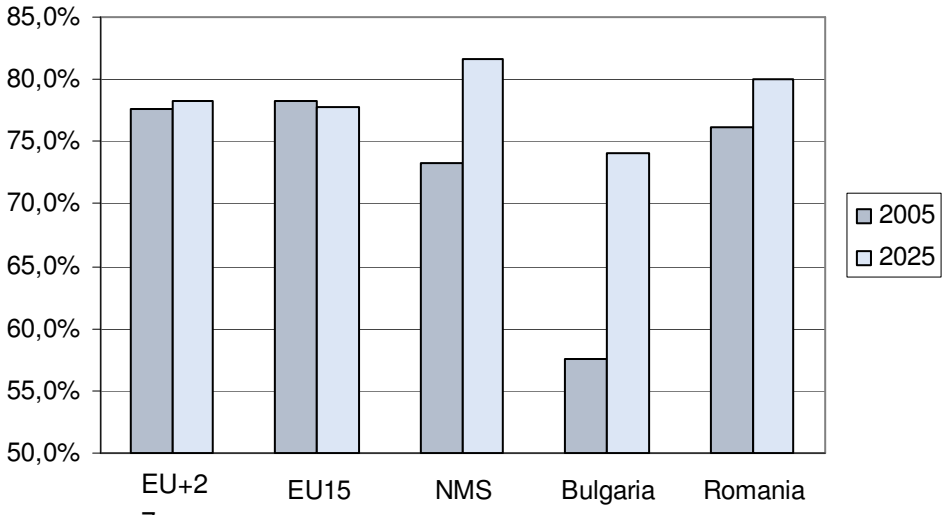
	2005	2020	2025	2030
EU+27	**100.0%**	**100.0%**	**100.0%**	**100.0%**
• Private car and motor cycle	77.6%	78.1%	78.2%	78.2%
• Bus and coach	8.4%	6.6%	6.2%	5.9%
• Rail	7.2%	6.5%	6.4%	6.2%
• Aviation	6.2%	8.2%	8.7%	9.1%
• Inland navigation	0.6%	0.6%	0.6%	0.6%
EU+15	**100.0%**	**100.0%**	**100.0%**	**100.0%**
• Private car and motor cycle	78.2%	77.9%	77.8%	77.6%
• Bus and coach	7.6%	6.2%	5.9%	5.6%
• Rail	6.9%	6.5%	6.4%	6.3%
• Aviation	6.6%	8.8%	9.3%	9.8%
• Inland navigation	0.7%	0.7%	0.7%	0.7%

Source: *Trends to 2030*, European Commission; modified by ECORYS for the years 2020, 2025 and 2030

Note: If EU25 is considered, the share of private cars and motor cycles in 2004 is 75.9% (Source: *Eurostat Statistical Pocketbook 2006, EU Energy and Transport in Figures)*

The previous table shows that the share of road passenger transport is expected to increase at the cost of public transport and rail transport. Particularly in the new Member States, the countries entered in 2004 and 2007, the share of road will increase considerably to comparable or even higher levels than in the EU+15 (see next figure).

Figure 2.2 Modal split: share of private cars/motor cycles in total passenger transport (based on passenger-kilometres)



Source: *Trends to 2030*, European Commission; modified by ECORYS

2.2.3 Congestion, road safety and environment

It is obvious that rising traffic levels lead to increasing congestion causing delays. The monetary value of congestion delays, according to TEN-STAC, will reach almost 9 billion Euro (2003 prices) for inter-regional traffic on the TEN-T network only by 2020.

The impact of wasted energy and time as well as the inefficiencies in transport operations arising from congestion could have an increasing impact on EU competitiveness, efficiency and employment. Traffic safety is also expected to worsen, partly because the predicted modal shift to road transport.

The modal shift, together with the absolute growth of traffic levels, results in higher emissions (green house gases and pollutants) and an increase in noise caused by traffic. The next table presents the expected increase in CO_2 emissions by the transport sector, again for the EU+27 as a whole and the EU+15 and new Member States separately.

Table 2.5 Expected growth in CO2 emissions by the transport sector

	2000-2020	2005-2025
EU+27	18%	9%
EU+15	12%	4%
NMS entered 2004	57%	36%
Bulgaria	165%	90%
Romania	201%	112%

Source: *Trends to 2030*, European Commission; modified by ECORYS

As a result of the economic development of the new Member States in the coming decades transport activities and thus energy use will be intensified. This will result in a significant growth in the emission of green house gases in the new Member States and an increased dependency on liquid hydrocarbon fossil fuels to support increased levels of transport activity.

2.3 European Transport Policy

The expected future performance of the European transport system, described in the previous section, has been recognised and acknowledged by the Commission during the process of developing the Common European Transport Policy.

Therefore the objective of the EU's Common Transport Policy is to develop a transportation system that meets society's future economic, social and environmental needs. Such a transportation system is essential to Europe's prosperity, having significant impacts on economic growth and employment, social development, road safety and the environment. This transportation system should:

- Offer a high level of mobility to people and business throughout the Union;
- Protect the environment;
- Ensure energy security;
- Promote minimum labour standards for the sector;
- Protect passengers and citizens;

- Innovate in support of mobility and protection by increasing the efficiency and sustainability of the growing transport sector.

2.3.1 Mid-term review White Paper

The problem with some of these wider objectives is that they are very general and do not lend themselves to detailed and precise measurement to contribute towards justifying the significant investments made in infrastructure projects. The 2001 Transport White Paper however has set some quantitative objectives:

- Decoupling between transport growth and GDP growth;
- Modal shift coming back to the 1998 modal split for EU+15 and keeping a weight for rail freight traffic of 35% for the new Member States;
- Road safety should be improved by reducing by 50% the number of fatalities.

The mid-term review of the Transport White Paper concluded that the modal shift objective within the EU+15 is not likely to be reached although the decline of rail transport has been halted in absolute terms. Concerning the indicative objective for the new Member States the 35% target for rail freight within inland transport (there were no objectives for passenger transport at the time) seems also problematic. Modelling exercises show that in the future the White Paper emphasis on modal balance as a prerequisite for sustainable transport could be attained by a *combination of measures*.

The most powerful combination of measures is expected to be the widespread imposition of user charges, reflecting externalities to all road users supported by *accelerated construction of the TEN priority projects*.

2.3.2 Other measures

Apart from the above mentioned combination of measures, the European Commission is also conducting various other measures to mitigate the negative effects of expected (road) traffic growth on congestion, road safety and environment.

An important Community support programme in this respect is the *Marco Polo II programme* running for the period 2007-2013. It aims at achieving a traffic shift or transport avoidance that is a substantial part of the expected yearly aggregate increase in international road freight traffic, measured in tonne-kilometres, to short sea shipping, rail and inland waterways or to a combination of modes of transport in which road journeys are as short as possible. The Commission estimates that every €1 in grants to Marco Polo II will generate at least €6 in social and environmental benefits.

Another example concerns the *Road Safety Action Programme (RSAP)* aiming at achieving the road safety goal as formulated in the White Paper. At Member State level various actions have contributed to lower levels of road deaths in the EU. Although the level of mobility has risen, the number of road deaths has decreased. In relative terms, road safety has thus improved considerably in the past decade. In other words, the fatality risk, i.e. the number of road deaths in relation to the level of mobility, has declined. However, the mid-term review of the RSAP concluded that present speed of reduction is too slow in view of the target for 2010. A better balance between transport modes,

supported by an acceleration of rail and inland waterway projects, could contribute to safer transport in the EU.

Clearly, other initiatives not mentioned here will also contribute to a sustainable transport system.

The next sections deal with only one measure, namely the (accelerated) construction of the TEN-T priority projects.

2.4 Trans-European Transport Network

The construction of the TEN-T is an important element of the development of a European transport system able to meet society's economic, social and environmental needs. The TEN policy ensures that the EU must aim to promote the development of TENs as a key element for the creation of the internal market and the reinforcement of economic and social cohesion.

The network contributes to the objectives of the European Transport Policy as described in section 2.3.

2.4.1 History of the TEN-T

In 1994 a list of 14 priority or so called 'Essen' projects was defined. In 1995 the first financial regulation for TEN-T support was adopted followed, in the next year, by decision 1692/96/EC specifying the Community guidelines for the development of the TEN-T. These guidelines defined the objectives of the TEN-T and set the timeframe: the TEN-T was to be established by 2010.

In 1999 regulation 1655/99/EC was adopted amending 2236/95/EC to cover the period from 2000 onwards and introducing the Risk Capital Facility (RCF). The RCF was initiated as a facility to provide risk capital to projects that are (partly) privately financed through PPPs.

Decision 1346/01/EC, adopted in May 2002 amended the TEN-T guidelines to also include seaports, inland ports and intermodal terminals. Furthermore, also in 2001, regulation 2654/01/EC introduced the "multi-annual programme" (MAP). The objective of the MAP is to secure smooth and timely financing for major projects on a multi-annual basis. This way, Member States are being given an indication of the likely allocation of funds over a period of several years, in advance. In October 2001, following the adoption of the White Paper, the European Commission initiated a first revision of TEN-T Guidelines. A revision of the financial regulations, asking for an increased EU support, especially for cross-border sections was also proposed.

Without waiting for the adoption of these proposals in 2003 it was decided to set-up a High-Level Group. The mandate was to select a number of Priority Projects and to investigate the need for a revision of the Guidelines and financial Regulations. This revision proved necessary and new guidelines and regulation were eventually adopted in

April 2004. The three most important changes were (i) that the deadline for completing the TEN-T was extended to 2020, (ii) that thirty Priorities Projects were selected and (iii) six European coordinators were installed. These coordinators need to encourage cooperation with users and operators of TEN-T projects, promote the projects amongst private investors and financial institutions, and keep the EU informed of progress.

In 2005 Mrs. de Palacio was appointed to chair the 2nd High-Level Group. The main recommendation from its report is that the focus should be on five major trans-national axes (Motorways of the Seas, Northern axis, Central axis, South Eastern axis, South Western axis). A revision of the guidelines and the financial regulations based on the report of the 2nd High Level Group is expected.

2.4.2 Implementation of the TEN-T

Below an overview is presented of the relatively slow progress on the implementation of the TEN-T axes and projects to date. It will show that progress is less than expected and will describe reasons why the implementation is lagging behind and identify some critical factors for implementation.

It should be realised the experiences with the multi-annual indicative programme (MIP) TEN-T 2001-2006 are presently being studied in a separate ex-post evaluation[22].

Progress of implementation[23]

In 1998 the overall picture was one of significant activity in difficult circumstances. The combination of low growth and fiscal consolidation in the period means that infrastructure spending overall has been below the long-term trend. Nonetheless, the 1998 implementation report noted that, as regards to the 14 Essen projects, there has been significant progress, with three projects close to completion, eight under construction or at a very advanced stage of preparation and most likely to be completed by around 2005.

The result of the implementation until 2001 was “solid progress, but needs to be better”. The total investment in the network was around €129 billion, nearly €90 billion higher than for the years 1996 and 1997. Furthermore, in line with Community policy, twice as much was invested in rail than in roads. It was also concluded that at this rate of investment the target of building the network by 2010 would not be achieved.

In 2003 still only three of the 14 Essen projects had been completed. Some of the other 11 were still at the preliminary studies stage. Overall, barely one third of the network had been built.

[22] This study is commissioned by DG TREN. This evaluation will be finished after the delivery of the final report of this ex-ante evaluation and can therefore not be used.

[23] Sources: TEN-T Implementation Report (2001), HLG1 Report (2003), Innovative funding solutions and Interoperability of electronic toll systems (2003), EVAluation and MONitoring of (EVAMONT) TEN-T (2003), Mega projects and Risk, An anatomy of ambition, author: B. Flyvbjerg (2003), Ex-post Evaluation of a sample of projects co-financed by the Cohesion Fund 1993-2002, (2005), CBA Externalisation TEN-T (2005), Mid-term review Transport White Paper ASSESS (2005), Strategic Evaluation on Transport Investment Priorities under Structural and Cohesion Funds for the programming period 2007-2013 (2006).

In 2005 no further Essen projects had been completed. In total 40% of the costs of the 14 original Essen priority projects had been invested and about a quarter of the investment of the 30 priority projects were made. Even though for some priority projects investment was very advanced (Paris-Brussels-Köln-Amsterdam-London, Madrid-Lerida-Huesca-Perpignan, Betuwe line, "Via Egnatia" and "Via Pathe") in general delays persisted.

The estimated total investment needed to realise the TEN-T network is € 600 billion. If only the priority axes/projects are considered a total of € 252 billion is needed.

Reasons why the implementation is lagging behind[24]

The following reasons for the rather slow implementation pace have been recorded:

- **Lacking budget.** The contribution of the EU (through the TEN-T budget and Structural and Cohesions Funds) for the entire period from 2000 to 2006 adds up to around €20 billion, which is 5 to 6% of the investments needed. The European Investment Bank (EIB) has in addition lent around EUR 50 billion in the same period. Member States need to find the majority of funding either from their national budgets and/or through Public-Private Partnerships (PPPs). Unfortunately most governments are hesitant with respect to funding TEN-T projects, particularly cross-border links. In 2003 the Member States put €15 to €20 billion into the various TEN-T projects, which is less than 0.3% of their GDP. Furthermore, there has been a lack of success in the implementation of infrastructure charging and the absence of private actors willing to invest in projects has further slowed down the progress.
- **Difficultly of coordinating.** Projects, especially cross border projects, are often slowed down through the intrinsic difficulty of coordinating their timetable, their financial planning and the related administrative procedures. Moreover, if the timing of connecting parts of infrastructure in different countries deviates strongly benefits of earlier investment can only be partly realized. The characteristics of the programming system in which countries individually define to a large extent their own programming priorities will more or less automatically lead to these failures in cross-border cooperation. It should also be acknowledged that the impact of completion of European corridors differs between countries. In general, a country will be more inclined to invest in a connection to the core of Europe than in a missing link toward more peripheral neighbouring countries.
- **Poor project preparation.** In a number of cases projects have not been fully developed by the project promoters in terms of technical (design) studies before application for TEN-T budget. This lack of maturity is one of the reasons for cost and time overruns. The attention paid to environmental aspects of projects is not always sufficient and also public consultation is often not given enough attention. Finally, risk assessment is an area in which serious improvements need to be made.
- **Non-optimal institutional setting.** Sufficient attention should be paid on the institutional and organizational setting of a project. Various analyses show that the impact of EU funds can be optimized by ensuring that investments are made in an optimal institutional setting. The modernisation and rationalization of transport (e.g.

[24] See footnote above

through institutional reorganizations, deregulation and market access) can be an important prerequisite to implement a project successfully.

2.4.3 Critical factors for implementation

Based on the aforementioned reasons why the implementation is lagging behind, the following critical factors for the implementation are identified:

- Financial resources
- Need for prioritization
- Need for coordination

Financial resources

The envisaged TEN-T budget for the MAP period 2007-2013 is around € 8 billion[25] which is by far not enough to realise the TEN-T network. The question is to what extent other sources of finance (EIB loans, Cohesion Fund and PPP/PFI) can help to speed up and reinforce the process.

The Cohesion Fund contribution for the TEN-T network for the period 2007-2013 for the 15 eligible Member States is estimated to be around € 54 billion[26]. It is envisaged that around half of this amount (€ 27 billion) will be spent on priority projects. The EIB loans account for around € 6-8 billion per year for the TEN-T (all for priority projects), i.e. an accumulated value of € 42-56 billion over the period. The scope for PPP is yet unknown, although several studies point out a clear tendency to implement more PPPs for transport infrastructure.

The total EU financial grants (TEN-T and Cohesion Fund) dedicated to the priority TEN projects in the period 2007-2013 are estimated to be around € 35 billion. The budget needed for the priority projects is € 252 billion in total of which it is assumed that € 126 billion (50%) is needed in the period 2007-2013, thus leaving a financing gap of € 91 billion.

The € 91 billion needs to be financed by Member States (either through EIB loans or directly from their national budgets) and potential public private partnerships (PPPs). If a modest estimate of 10% of the amount is to be financed from PPP is used, this still leaves € 82 billion to be financed by the Member States. It was mentioned that the Member States dedicated € 15-20 billion in the year 2003 to the TEN projects, of which it is assumed that about half (€ 8-10 billion) is dedicated to priority projects only. If the pace of investment from Member States in this programming period would be equal to the year 2003, a total of € 56-70 billion would be spent. This means that still a financing gap of € 12-26 billion would exist.

Therefore it is concluded that, although the TEN-T budget is highly increased compared to the period 2000-2006, in the programming period 2007-2013 the financial need for the

[25] Source: Draft multi-annual work programme for grants in the field of the Trans-European Transport Network (TEN-T) for the period 2007-2013 (Commission Decision C(2007) 2158)

[26] Strategic Evaluation of Transport Investment Priorities co-financed by the SF and the ERDF for the period 2007-2013, ECORYS on behalf of DG Regio

realisation of the TEN-T in this period will probably still exceeds the total (CF, EIB, MAP TEN-T, PPP and national) budgets available.

Prioritization

Because the MAP TEN-T budget and the administrative and organizational capacity of both the European Commission and the Member States are limited it is important to prioritize these means. The distinction between priority axes/projects and other TEN-T projects might not be enough in this respect, since the budget available in the period 2007-2013 is insufficient to realize all projects.

An example of a further prioritization is to focus Community activity on reducing the bottlenecks on major trans-European routes to complement national projects to alleviate bottlenecks. Another option could be to focus investment on cross-border sections, since these projects often do not have priority from a national point of view for instance because there may be not enough national co-financing.

Coordination

To ensure effective and timely implementation of the proposed measures along the axes there is a need for stronger and more effective coordination frameworks[27]. The six European coordinators appointed by the Commission encourage cooperation with users and operators of TEN-T projects, promote the projects amongst private investors and financial institutions, and keep the EU informed of progress.

2.4.4 SWOT-Analysis

Based on the preceding sections a strengths, weaknesses, opportunities and threats (SWOT) analysis has been drawn up for the implementation of the TEN-T.

[27] Source: HLG2 report

Strengths	Weaknesses
• Contribution to the goals of the European Transport Policy • Positive economic impact of past transport infrastructure investment	• Time- and cost overruns in the implementation of projects • Country focus at times hampers cross border completion of projects at same time (country interest does not always equal EU interest); • Low recognition of TEN-T involvement in national schemes and international projects
Opportunities	**Threats**
• Increased funding levels through Cohesion Fund, MAP TEN-T and private sources; • Increased possibility for the collection of road based income (e.g. road taxes, congestion pricing, road tolls etc.); • GDP increases (increased demand, enhanced capacity to pay for transport services; enhanced public revenue)	• Limited funding • Poor preparation and subsequent quality of projects • Lack of adequate pricing policy • Limited administrative, organisational and technical management capacity • Lack of cross-border co-ordination and interoperability • Persisting “national egoism”

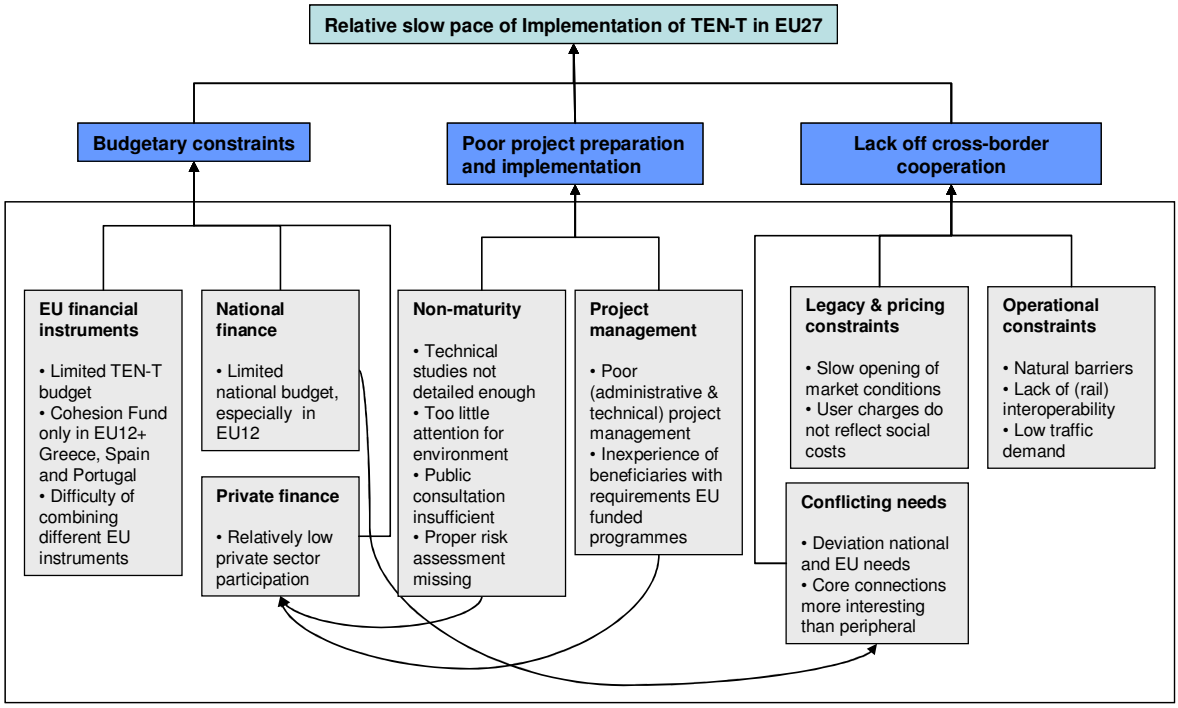
2.5 Conclusion: problem identification

The problem analysis concentrates on the aspects related to the realization of TEN-T projects. The major problems hindering a successful implementation of the TEN-T are listed below. These are to a large degree related to each another:

- Limited (insufficient) available budget to complete the TEN-T within the originally foreseen time frame until 2020
- Poor project preparation and poor administrative and technical management by project promoters
- Inefficient or lack of cross-border cooperation, due to among others conflicting EU and national needs

The next figure provides in more detail an overview of problems and underlying causes. It shows that many causes have been identified that explain a relatively slow pace of implementation of TEN-T projects.

Figure 2.3: Problem tree



The budgetary constraints consist of the existence of a rather limited EU TEN-T budget for works. Secondly national finance sources are not sufficient to realise these projects and private finance sources do not bridge the total financing gap.

Poor project preparation and implementation is mainly related to the quality of the feasibility studies, risk assessments, too little attention for environmental impacts and insufficient public consultation. The actual project management (implementation) is in some cases below proper quality standards.

The apparent lack of cross border cooperation is mainly because of deviations in EU and national needs. The European axes sometimes do not add much to a single country despite the fact that this country needs to bare part of the costs. Countries are reluctant to invest in projects that are not beneficial to their country and opt to invest in national project, ignoring the European dimension. Natural barriers, lack of rail interoperability and low traffic demands further undermine cross border cooperation.

It should be noted that the contribution of the Commission, more in particular DG TREN, to solve these problems differs per category. Obviously, in some areas, like the project promoters' project management, the influence is limited. The role of the Commission is more visible in trying to overcome budgetary constraints and promoting cross- border cooperation.

3 Objectives and indicators

3.1 Objectives

This chapter deals with the objectives of the MAP TEN-T. The objectives need to be consistent with other EU policies and objectives, for instance the Lisbon Agenda and those on sustainable development, competition and territorial cohesion. The MAP TEN-T addresses different levels of objectives:

- *General objectives*: objectives which correspond with the overall wider policy goals of the intervention. These objectives are also influenced by other factors, but the intervention is expected to have a positive contribution towards them.
- *Specific objectives:* more immediate objectives of the intervention that contribute to achieve the overall objectives. Also these objectives are influenced by factors outside the direct control of the policy intervention;
- *Operational objectives*: these objectives are related to the expected outputs of the measure.

General objectives

The general objectives are formulated as follows, taking into account the objective of the revision of the Community guidelines as presented in the extended impact assessment (COM(2003)/645 final):

- To contribute to a sustainable transport system at European level by giving priority to investments in environmental friendly modes in view of rebalancing modal shares
- To further integrate transport networks of the EU+12 with those in the EU+15 and improve the quality of the networks in the EU+12 in order to reduce travel time, travel cost, accidents and environmental damage from transport
- To contribute to strengthening the EU's competitive position by improving the quality of the core transport network in the EU+27

These objectives are clearly formulated on a rather high level. Therefore, a set of specific objectives have been developed.

Specific objectives

The specific objectives are related to the specific area that is addressed by the MAP TEN-T, being:

- To speed-up the realisation of the TEN-T priority projects
- To improve the cost-effectiveness of the TEN-T financial means

Operational objectives

The operational objectives are related to the concrete activities that result from the MAP TEN-T. It is expected that the intervention addresses the following operational objectives:

- To improve the quality of project preparation
- To improve coordination between countries
- To increase the sense of urgency regarding the realisation of the TEN-T projects
- To optimise the use of financial instruments, attracting financing from additional sources (PPP

3.2 Indicators

In order to assess, monitor and evaluate the impacts of the MAP TEN-T, indicators are needed. In general there are three different levels of objectives (general, specific and operational objectives) to be measured by three corresponding levels of indicators.

1. *Outcome or impact indicators*: these indicators are used to measure the ultimate impact or outcome of a project and correspond with the general objectives of a programme or activity. Generally these are expressed in rather global terms (e.g. competitiveness, safety, environment, etc.). Often these global indicators are also influenced by other factors, but the intervention should have a positive contribution towards them. The outcome or impact indicators related to the MAP TEN-T might be GDP growth resulting from the investment in infrastructure enhancements.

2. *Results indicators*: are measures to verify to what extent the more specific objectives of a policy have been achieved, i.e. the targets which need to be reached in order to achieve the overall, general policy goal. They are expressed in direct and short-term effects of the intervention. Result indicators related to the MAP TEN-T are for example travel time savings (passengers), congestion and emissions.

3. *Output indicators*: these indicators measure the deliverables that the intervention is expected to produce, in other words the products or output of a measure to reach the operational objectives. The achievement is under direct control of the policy and can directly be verified. Output indicators related to the MAP TEN-T are for example the number of realised TEN-T cross-border projects, or the attraction of additional private financing.

Identifying indicators for monitoring

Indicators are a concrete translation of the objectives into measurable units. This translation will allow the measurement and assessment of the various policy options and enable adequate monitoring and evaluation of the intervention. The indicators on the level of specific and general objectives are closely related to the problems and the expected impacts of measures, while the operational objectives result in more practical indicators to the actions undertaken.

The table below provides a proposal for such indicators. It is noted that the units to be used for some of these indicators still need to be established.

Table 3.1 Objectives and proposed indicators MAP TEN-T (initial, non-exhaustive list)

Objectives	Indicators
General objectives	
• To contribute to a sustainable transport system	• Efficiency of the EU+27 transport system measured in average travel speed and freight transport cost per tonne-kilometre • Modal shift towards rail
• To further integrate transport networks of the EU+12 with those in the EU+15 and improve the quality of the networks in the EU+12	• Network quality • Network integration
• To contribute to strengthening the EU's competitive position by improving the quality of the core transport network in the EU+27	• GDP growth • Direct and indirect job creation • Territorial cohesion
Specific objectives	
• To speed-up the realisation of the TEN-T	• Average implementation period • Number of TEN-T projects realised
• To increase the cost-effectiveness of the TEN-T financial means	• Number of travel time savings (passengers and freight) per Euro MAP TEN-T budget invested • Emission levels per Euro MAP TEN-T budget invested • Traffic safety per Euro MAP TEN-T budget invested
Operational objectives	
• To improve project preparation	• Quality of project applications • Quality and number of risk assessments included • Number of TEN-T projects (works) that start without delay
• To improve coordination between countries	• Number of cross-border projects realised • Number of integrated cross-border planning schemes
• To increase the sense of urgency	• National budgets allocated to TEN-T
• To optimise the use of financial instruments, stimulating attracting additional finance (PPP)	• Number of and amount of private funds attracted

4 Stakeholder consultation

4.1 Introduction

In this chapter the results of the stakeholder consultation are presented and analysed. The stakeholder consultation focussed on three groups of stakeholders:

- TEN-T Coordinators (interviews)
- European organisations (interviews)
- Member States (questionnaires)

In the next three paragraphs the results for each stakeholder group is presented. Firstly, some remarks will be made regarding the response. Next, the results will be presented. In paragraph 4.5 conclusions will be drawn.

4.2 TEN-T Coordinators

4.2.1 Response analysis

This section provides an overview of the results of the consultation of the European Coordinators. The following coordinators have been interviewed[28]:

- Mr. Balász (Priority Axis No. 17)
- Mr. Davignon (Priority Axis No. 3)
- Mr. Telicka (Priority Axis No. 27)
- Mr. Van Miert (Priority Axis No. 1)

4.2.2 Synthesis of the results

Financial Funds available

The following comments were made in relation to the different financial funds available for financing the implementation of a TEN-T project.

[28] No interview was held with the fifth coordinator Mr Vick (horizontal priority ERTMS). However his views shared on the TEN-T Days (10-11 May 2007) were taken into account.

Table 4.1 Comments of TEN-T Coordinators on financial funds available

Financial funds	Comments
TEN-T Budget	Being able to use the TEN-T budget to finance a certain TEN-T project accelerates developments by years (not months)
Structural and Cohesions Funds	No comments
Loans of the EIB	No comments
National Funding	No comments
PPP	The suitability of using PPPs to finance TEN-T projects depends on the nature of the project and on the conditions placed upon investment by the private parties. At the moment PPPs are beginning to be more used. They are most of all suited for projects in cities, like for example renovation of old stations, because these projects offer a lot of private business opportunities. Creating more PPPs is important but difficult, among other things because of the lack of entrepreneurship (in certain countries of the EU).

There is no optimal mix of budgets for financing the TEN-T projects. This should be examined on a case by case basis.

Problem analysis

The European Coordinators have identified the following problems which may hinder the implementation of the TEN-T projects.

Table 4.2 Comments of TEN-T Coordinators on problem analysis

Problems	Description
Lack of budget	The biggest obstacle is the lack of money. The TEN-T budget of the European Commission is small, which limits the ambitions that can be realized.
'National egoism'	There is a low degree of solidarity between the Member States involved. The different interests of the Member States result in different perceptions concerning the direction of the project.
Political instability	There is a lack of political stability (governmental changes and/or officials) which hinders the continuation of the process at certain times, especially during elections. With 27 Member States this 'stability problem' has got worse, as the frequency of elections in the EU has increased.

Solutions to the problems

The following improvements should be considered to speed up the process of implementation of the TEN-T projects.

Table 4.3 Comments of TEN-T Coordinators on improvements

Improvements	Description
Increasing commitment	Establish long term commitments of Member States to the implementation of projects and the accompanying time tables (i.e. through official mandates and declarations which are binding). The EC should put more pressure on Member States to formalise these commitments by emphasising the importance of TEN-T.
Prioritization	The limited TEN-T budget should be allocated towards fewer projects, although the choice between projects is difficult and involves a high degree of political courage. Criteria that can be used to select the most important projects are described below this table.
Simplifying procedures and increasing flexibility	The allocation of the European Funds should be more flexible: e.g. make it possible to allocate both TEN-T budget and Cohesions funds and to impose a lower or higher level of co-financing in certain projects. Furthermore, the administrative procedures of the EC, before subsidies are awarded, have to be simplified and shortened. 5 to 6 years is definitely too long. The EC should award the money more quickly, even if this would involve more risk.
Better coordination	The Member States should cooperate more and should be willing to formalize their willingness to contribute (financially). But also the European Coordinators have an important role to play. These coordinators are independent professional (installed by the European Commission) who are focusing on the general EU interest rather than the interests of the individual Member States. European Coordinators can, outside of the official procedures, contact (potential) project partners to speed up the implementation of the TEN-T.

Prioritization

According to the European coordinators the TEN-T budget should be allocated towards fewer projects. Priority should be given to the following types of projects:

- Cross border or bottleneck projects.
- Projects capable of starting fast.
- Projects capable of being implemented relatively rapidly.
- Projects supported by a government willing to co-invest.

4.3 European organisations

4.3.1 Response analysis

In this section the results of the consultation of the European organisations are described. The following organisations have been interviewed[29]during the stakeholder consultation:

- International Union of Railways (UIC)
- European Intermodal Association (EIA)
- Inland Navigation Europe (INE)

[29] Although the International Road Union has been invited to participate in an interview no response has been received

- European rail infrastructure managers (EIM). EIM has sent their report *Finding the funds* as an official statement to the questionnaire and no additional interview took place.

4.3.2 Synthesis of the results

Financial funds available

The following comments were made in relation the different financial funds available for financing TEN-T projects.

Table 4.4 Comments of European organisations on financial funds available

Financial Funds	Comments
TEN-T Budget	The TEN-T budget is small, compared to the other financial funds available, but it is important. Without contributions from this budget many projects would not be realized.
Structural and Cohesions Funds	No comments
Loans of the EIB	No comments
National Funding	The major part of the financing for the TEN-T projects has to come from national contributions.
PPP	PPPs still prove to be difficult to implement and in a number of cases it would be better to implement a project purely on a public basis. The national governments should somehow provide more security to private investors and make these kinds of investments more interesting. For example by offering a tax discount. Another important precondition for PPPs is a high quality of project preparation, decreasing the amount of insecurity for private actors.

Problem analysis

European organisations identified the following problems which may hinder the implementation of the TEN-T:

Table 4.5 Comments of European organisations on problem analysis

Problem	Description
Lack of budget	A major problem is the limited size of the financial funds available (especially the TEN-T budget).
'National egoism'	The National Ministries of Transport have a major influence on the implementation of the TEN-T, but their interests do not necessarily coincide with EU priorities. So far, national projects have been preferred instead of international projects. There is of course a relation with the previous problem since the major part of the financing for the TEN-T projects has to come from national contributions.

Solutions to the problems

The following improvements should be considered to speed up the process of implementation of the TEN-T:

Table 4.6 Comments of European organisations on improvements

Improvements	Description
Increasing commitment	The Commission should incentive Member States to co-invest, especially in cross border projects; otherwise the national projects will be preferred. The most obvious way to do this is by increasing the co-financing rate from the TEN-T budget. It might also help if an EU presidency puts the implementation of the TEN-T projects high on the political agenda. Furthermore the process of implementation might be supported by establishing (multi-lateral) Memoranda of Understanding between governments. Through that, Member States will commit themselves to the implementation of international projects. However, Member States should do more than agree on MoUs. They should create a system of treaties for each corridor in which the Member States oblige themselves to complete the corridor in a certain time frame and earmark a certain budget for it. The European Coordinators could oversee this and could also confront a Member States in case it is not acting according to this treaty.
Prioritization	It would be better to concentrate on a number of important corridors or an integrated core network[30], instead of unfocussed development of the entire network. Thereby the EC should make the choice to use the TEN-T budget only to finance the really important projects. Below it is described based on which criteria the most important projects should be selected.
Better coordination	There is a need to create an EU vision (master plan) to be streamlined with national projects of the Member States. Furthermore the European Coordinators can play an important role in speeding up the implementation of the TEN-T network. However, the usefulness of European coordinators to solve problems depends completely on his or her flexibility and diplomatic skills.

Prioritization

According to the European organizations priority should be given to the following types of projects:

- Projects in non-Cohesion Fund countries. The peripheral regions should rely relatively more on Cohesion Fund support
- Projects that improve connections of the EU to other parts of the world (China, India, Africa, etc) and/or project on the core central network. The core central network could be considered to be located within the area bounded by the following cities: Amsterdam-Brussels-Paris-Lyon-Milano-Budapest-Warsaw-Berlin with connecting corridors to all other part of the European network.
- Smaller individual projects geared towards a global objective (e.g. for works to increase permitted train lengths or loading gauge on certain corridors. As an example, in relation to ERTMS, a 500 million Euro funding reservation is being contemplated).
- Bottleneck and cross border projects, whereby the following are specially named:
    - Cross border connection between Germany and Switzerland;
    - Railway line between Prague and Dresden;
    - Tunnel between Germany and Scandinavia;

[30] UIC has studied this in more detail, leading to a Rail Master Plan, in which areas with deficiencies (in terms of e.g. speed, axle loads etc) on the existing network have been identified. The report is not finalised yet.

- The link across the Pyrenees;
- The cross border railway connection of the Betuweline on German territory;
- The cross border railway connection between Germany and Poland;
- Free flow part of the Rhine-Danube corridor between Straubling and Vilshoven;
- River Elbe bottlenecks (if the depth of the river would be improved, it would be suited for the transport of a large amount of containers from the port of Hamburg to the hinterland).
- The improvement of the east-west corridor (Rotterdam-Warsaw) especially for rail freight. This is one of the ERTMS corridors, but also other investment is needed to improve the service quality of the corridor.

4.4 Member States

4.4.1 Response analysis

In this paragraph the answers to the consultation of the Member States are analysed. A total of 13 (of the 27) Member States have replied to the questionnaire: Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Finland, Greece, Hungary, Latvia, Malta, Spain, Slovenia and the United Kingdom.

4.4.2 Synthesis of the results

Seven of the thirteen responding Member States have no experience with the multi-annual indicative programme (MIP) TEN-T 2001-2006. The remaining Member States judge the MIP 2001-2006 as being successful in concentrating TEN-T funding for most important projects and contributing to the greater competitiveness of Europe. Furthermore, where cross border cooperation is needed, European support has encouraged the making of contacts.

Financial funds available

The following comments were made in relation the different financial funds available for financing the implementation of TEN-T project. The second column indicates how many of the Member States regarded this financial fund as being important for the implementation of the TEN-T network, besides the TEN-T budget.

Table 4.7 Comments of Member States on financial funds available

Financial Funds	Fund important for implementation of TEN-T projects (# respondents)	Comments
TEN-T Budget	13	12 (out of 13) of the Member States consider the TEN-T budget as absolutely necessary in the realisation of the TEN-T network and 13 (out of 13) Member States consider that the TEN-T budget leads to speeding up the realisation of the TEN-T network.
Structural and Cohesions Funds	9	The countries with limited financial resources (Bulgaria, Czech Republic, Hungary, Latvia and Malta) see the Structural and Cohesion Funds as the key factor for realization of the TEN-T projects.
Loans of the EIB	3	No comments
National Funding	6	UK, Denmark and Finland mention that national funding is always the key factor for implementation of TEN-T projects.
PPP	5	It is believed that there is a good potential for PPP to form an element of TEN-T project realization. These PPPs mobilize complementary financial resources, improve project management (by combining public experience and private skills as well as financial capacity of private investors) and allow for a more efficient allocation of risks. Only Denmark thinks that PPP in relation to TEN-T projects is going to be even more difficult than in many national projects. The UK states that the private sector is interested in participating in TEN-T projects if it is supported by a clear implementation methodology and a knowledge that this has been applied in selecting the projects. Latvia sees PPP as the main solution since public financing is insufficient in their country. According to Belgium the PPP financing costs compared with a 'classic' financing remains a problem, just as the loss of information on the advancement stage and the real costs of the infrastructure realization.

According to most countries the optimal mix of these funds is found to be dependent on several variables: the needs, targets and priorities of the project. Furthermore, some instruments are not available in all EU countries (like the Structural and Cohesion Funds). Spain indicates the TEN-T budget has been used mostly for studies, while the Structural and Cohesions Fund have been used to finance the construction of infrastructure.

Problem analysis

Member States encounter the following problems which may hinder the implementation of the TEN-T:

Table 4.8 Comments of Member States on problems

Problems	Number of Member States
Lack of cross-border cooperation for transport infrastructure development.	4
Lack of cross border inter-operability and slow pace of technical reforms to achieve this.	4
The continued dominance of national market service providers influencing the type, scale and timing of new projects.	1
Serious delays in the implementation of large infrastructure project due to poor project preparation	2
Serious delays in the implementation of large infrastructure project due to poor project management	1
Potential internal conflict between TEN-T objectives and intentions in relation to EU 2020 transport policy (e.g. motorway development in conflict with rail and IW support measures).	2
Low level of recognition of TEN-T initiatives, priorities and existing levels of involvement in multi-lateral projects.	1
Limited financial resources	1

Solutions to the problems

The following improvements should be considered to speed up the process of implementation of TEN-T projects:

Table 4.9 Comments of Member States on improvements

Improvements	Description
Prioritization	Concentration of TEN-T funding on those projects playing a vital role in the completion of a TEN-T axis. Below this table it is discussed based on which criteria it should be determined which projects should receive funding.
Simplifying procedures and increasing flexibility	Administrative procedures should be simplified and based on clearly defined criteria to decrease the bureaucratic and time consuming application procedure. Also, the flexibility of using the different financial funds (ERDF, Cohesion Fund, TEN-T budget, PPPs, national budget, etc) should be increased. This would allow using the available funds more efficient and thereby creating a greater impact. Greater flexibility is also needed in order to accommodate corrective measures e.g. about the re-allocation of non-used TEN-T budget.
Better coordination	The priorities of the European Commission should be streamlined with those of the Member States. Furthermore the European Commission should provide guidance to Member States, such as guidance on the co-ordination work involved for cross-border projects. The Agency should also provide necessary administrative capacity to carry out regular checks in order to ensure the smooth running of the Programme. Thereby the variable conditions existing in each Member State should be taken into account. The specific role of the European Commission, but also those of the Member States and Ministries of Transport are discussed in more detail below.
Funding alternatives	Other funding alternative should be explored or used more intensively, e.g. Pricing, the Loan Guarantee Scheme and the creation of a 'Reward' budget. • Pricing is seen as a difficult issue. Latvia sees pricing as a favourable instrument to speed up the realization of the TEN-T networks. The United Kingdom however mentions that it does not believe it is necessary to have an EU wide road pricing policy beyond the requirements set out in the EU Directive 2004/52. Road pricing is considered as method of limiting the levels of congestion and not to raise revenue as a replacement for other public expenditure. Belgium claims infrastructure charging for roads can be used to make available the required resources for completing the TEN-T. • The Loan Guarantee Scheme, a commitment of the European Commission for TEN projects to provide a cushion for unexpected shortfalls in the cash flow available for debts service, may have a positive effect to speed-up the completion of the TEN-T network. On the other hand two Member States think that such a cushion would not be effective or only to a minimal extent. The Guarantee instrument should not be concentrated on leveraging in extra private finance, the emphasis need to be on getting value for money: to be achieved by properly allocating risks to the party best able to manage them and to make sure that the private sector is properly incentivised to manage the risks it agrees to take. • A 'Reward budget' might be given to those projects that have demonstrated exceeded implementation abilities as well as they need for extra support. The programme then works as an incentive not only to do it well but to do it better.

Prioritization

The Member States were asked whether they believe focused support (earmarking of TEN-T budget) to bottleneck projects, cross-border projects or certain regions/countries is needed. The results are listed in the next table.

Table 4.10 Comments of Member States on whether focussed support is needed

Focused support needed on	Yes	No
Bottleneck projects	10	2
Cross-border projects	8	1
Certain regions/countries	7	5
Certain modalities	5	7

The majority of the respondents think that focused support to bottle-neck or cross-border projects is needed. One of the Member States who does not believe that focused support to bottleneck projects is needed, says that they are too difficult to define. Of the Member states who do believe that this is necessary one of the arguments is that otherwise there is a risk that countries located on the outskirts of the EU will receive no support at all. Although the importance of developing a commonly accepted system of identifying bottlenecks and cross-border project is emphasized another Member State states that funding should always be justified on a case by base basis and money should be deviated to those representing the highest added value.

There are mixed feelings regarding focused support for projects in certain regions or countries. Member States that support this idea say that it may improve the accessibility of outstanding regions. Another Member State agrees that TEN support should focus on those Member State which are in greater need for funding, therefore where the funds are more likely to represent Value for Money (increasing productivity, optimization of the network, environmental improvement, etc.). A third respondent thinks that countries which networks lag behind from the most developed ones should receive additional support. Member States that do not approve of focused support for projects in certain regions or countries say that the selection of the projects should always be based on the merits of the projects. Finland an Cyprus are of the opinion funding is concentrated too much on central areas of Europe and that connections in more peripheral (and island) areas should have been given a higher priority in the TEN-T policy. Because the Structural and Cohesion fund are already used to support less developed regions, Spain on the other hand understands the TEN-T budget does not have to be used to favour certain regions or countries.

The majority of the respondents think that focused support to certain modalities is not needed: in order to optimize the efficient use of all modes of transport it is felt that TEN-T funds should be allocated to all modes. The Member States who do think that focused support to certain modalities is needed think that this is necessary to reflect the priorities of the transport policy (e.g. environmental friendly modes of transport).

Better coordination

The Member States have indicated the European Commission, Member States and Ministries of Transport have the following responsibilities in relation to implementation of the TEN-T network.

Table 4.11 Comments of Member States on responsibilities of different actors

Actor	Responsibilities
European Commission	• Promoting the catalyst effect of TEN funds • Coordinating, particularly on cross-border projects that are of strategic interest to a number of Member States and where implementation is delayed due to technical difficulties. • Giving support to overcome the barriers related to acceptability of pricing (mentioned only by Member States who have mentioned pricing as a policy option). • Supporting Member States in providing the national funding for the TEN-T projects • Ensuring a correct methodological process • Ensuring equal access for all member states in funding TEN-T projects. • Providing funding from the TEN-T budget
Member States	• Promoting the catalyst effect of TEN-T funds • Taking responsibility for project implementation and realization • Providing national funding • Submitting applications forms • Monitoring the project and identifying practical problems
Ministry of Transport of a Member State	• Prioritizing the projects at the national level in the applications phase • Giving inputs for project proposals, consulting/guidance, monitoring, providing feedback • Ensuring completion of corridors in the most cost-effective way • Liaise with the European Commission and stakeholders • Coordinating the activities in a proper way to ensure harmonization with national transport policies

4.5 Conclusions

Below the most important findings from the stakeholder consultation are summarized. Attention is specifically given to those elements that were emphasized by all three groups of stakeholders. For the solutions raised it is indicated whether the (MAP) TEN-T programme management could contribute actively.

Financial funds available

Essential remarks about the different financial funds available for financing the implementation of the TEN-T that were made by stakeholders from all three groups are:

- On the one hand the TEN-T budget is considered to be an important source of finance. Allocation of this budget to a project can accelerate development by several

years. On the other hand the total TEN-T budget available is considered to be (too) small.
- The major source of finance for TEN-T projects is national funding (and Structural and Cohesion Funds in countries with limited financial resources)
- PPPs could become an important element of project realization, although creating the conditions required for PPPs can be difficult. One of these conditions is that projects are well prepared. But even then some projects are better suited than others for PPP constructions.
- There is no optimal mix of budgets for financing TEN-T projects. The suitability of using different financial funds is dependent on the specific character of the project.

Problem analysis

Two major problems hindering the implementation of the TEN-T were identified by all three groups in the stakeholder consultation.

- The total of the financial means (TEN-T budget, Structural and Cohesion Funds, Loans of the EIB, National Funding, PPP) available is not enough to realize the TEN-T in line with the original planning.
- There exist major difficulties in coordinating cross-border project which are caused, among other things, by conflicting EU and national needs. These conflicting needs are also limiting the amount of national funding that is awarded to certain TEN-T projects.

Solution to the problems

To solve these problems a number of solutions were proposed, of which the following were named most often:

- Prioritization of the TEN-T budget. This limited budget and administrative capacity should be allocated towards the most important projects: projects that will eliminate major bottlenecks and cross border projects. It was raised that perhaps these projects should also be awarded higher co-financing rates, which might help to convince Member States to reserve (higher) national funding. This latter element is however at present considered to be unrealistic, since the financial regulation does not allow for higher co-financing rates. The TEN-T programme management can play an active role in the prioritisation of the (MAP) TEN-T budget.
- The simplification of administrative procedures and increase of the flexibility of using the different (European) financial funds have also bee raised. No information on proposals for the simplification has been collected, therefore this remark is considered to be too general and not very useful for this study[31]. The allowance of more flexibility of using different EU funds is considered to be unrealistic, given the procedures described in the financial regulation.
- Improving (cross-border) coordination. In order to do this the Commission should provide guidance and support to the actors involved in TEN-T projects, especially on the coordination work involved in cross-border projects. The Member States on the other hand should (formally) commit themselves to the completion of these projects within a certain timeframe. This would include formalizing their willingness to participate in cross border cooperation and to contribute financially. The European

[31] The ex-post evaluation of the MIP TEN-T 2000-2006 (scheduled to be finalised in October 2007) is likely to present a detailed analysis of the administrative procedures and potential simplifications.

coordinators can contact and stimulate partners outside of the official procedures, but also point them to their official obligations.

Relation with the problem analysis

The problems that were identified by the different stakeholders in this chapter correspond to a large degree to those identified in chapter 2. Also in the stakeholder consultation the problems of lacking budget, poor project preparation and implementation and the lack of cross-border cooperation are seen as major obstacles for the completion of the TEN-T.

Other elements mentioned in the stakeholder consultation that hinder the implementation of the TEN-T but that do not appear that prominently in the problem analysis are the lack of political stability and potential internal conflict between TEN-T objectives in relation to EU 2020 transport policy (e.g. motorway development in conflict with rail and IW support measures). The lack of political stability (governmental changes and/or officials) hinders the continuation of the process at certain times, especially during elections.

5 Policy options

5.1 Introduction

Before defining the policy options, it is important to elaborate on the key question to be answered by this study, namely: *"how could the MAP TEN-T budget for the period 2007-2013 be used best to speed-up the realisation of the TEN-T?"*.

Three dimensions play an important role for answering this question:

- Type of projects to be co-financed
- Distribution of the budget between works and studies
- The impact of the MAP TEN-T on the maximisation of other financial sources available

The type of projects means that some projects, like cross-border projects, do need a stronger "push into the right direction" because of low Member State(s) interest(s).

The distribution of the MAP TEN-T budget between works and studies directly relates to the relation between proper project preparation and speeding-up of the actual projects. In case the preparation phase is well studied, this might avoid problems in the implementation and it could lead to an increase in the bankability of projects.

The last dimension, using the available funds effectively, deals with the possibility to attract private finance for the TEN-T projects.

This chapter focuses on the definition of the policy options, from the perspective of concentrating the MAP TEN-T budget on specific type of projects (cross-border, bottlenecks, and a combination of European Added Value projects). The other dimensions mentioned above, will be tackled in chapter 7.

5.2 Methodology

This section considers the further substantiation of the policy options. The following options are envisaged:

- **Option 1 "Corridor concept"**: A mix of cross-border and bottleneck projects situated on the priority axes/projects.

- **Option 2 "Cross-border focus"**: Only cross-border projects situated on the priority axes/projects. This includes Motorways of the Sea projects.

- **Option 3 "Bottleneck focus"**: Only bottleneck projects situated on the priority axes/projects.

- **Option 4 "European Added Value"**: Any project of high European Value Added situated on the priority axes/projects.

Each of the policy options firstly needs to be substantiated in terms of which infrastructural projects are to be included. The next sub-sections describe the selection procedure, which is used to identify the projects to be included in each of the policy options. The selection procedure is based on pragmatic and realistic criteria[32] which are applied in a Multi-Criteria Analysis to identify the projects that might receive financial support from the TEN-T budget.

The project selection methodology is described in more detail in Annex 2 for each policy option separately.

5.2.1 Budget available for works

The total amount available for grants on the basis of the multi-annual work programme in the field of TEN-T ranges from € 6.4 billion to € 6.8 billion[33] for the period 2007-2013. The indicative amount for the priority projects, including Motorways of the Sea (€ 310 million) and excluding horizontal priorities (€ 1.2 billion) and Galileo (€ 190 million), is between **€ 5.0 billion and € 5.4 billion**[34].

The following general assumptions have been made regarding the allocation of the TEN-T budget:

- 10% of the budget allocated to studies (of which up to 50% co-finance)
- 90% of the budget allocated to works, of which
  - maximum of 20% co-financing in priority projects;
  - maximum of 30% co-financing in cross-border projects and natural barriers;
  - maximum of 10% co-financing in other projects.

When applying the 10% share for studies, this results in a total amount of between **€ 4.5 billion and € 4.9 billion** available for construction of infrastructure. It is assumed that the 10% share for studies is directly linked to the selected projects in the policy options.

Each policy option consists of a **maximum** and **minimum** scenario which related to the overall number of projects. In the "minimum number of projects" scenario, the maximum co-financing rates per type of project apply (relatively low number of projects), whereas

[32] Ideally the criteria to be applied should be in line with the criteria applied in the High Level Groups. However, these criteria are not known to the consultants.

[33] The remaining part of the financial reference amount of € 8,013 will be subject to separate work programmes and/or annual financing decisions. Source: Draft multi-annual work programme for grants in the field of the Trans-European Transport Network (TEN-T) for the period 2007-2013 (Commission Decision C(2007) 2158)

[34] DG TREN Presentation "TEN-T Financial Assistance Committee, Brussels, 2 March 2007".

in the maximum projects scenario the co-financing rate is only half of the maximum (leading to more projects).

The new Regulation for the TEN Programme[35] stipulates that all Member States are eligible to participate in the multi-annual programme on an equal basis. However, there is a strong political imperative[36] for the Commission to coordinate the TEN-T budget with the Structural Funds foreseen for transport[37] (with emphasis on Priority Projects), which offer much higher Community funding rates of up-to 85%. Since on the one hand predominantly the new Member States EU+12 are eligible for the structural funds, and on the other hand this study aims at maximising the acceleration of network completion by the TEN-T Programme despite its relatively low budget, only for the purpose of this study it is assumed that the TEN-T multi-annual programme budget is for the EU+12 countries only used for studies. It is therefore further assumed, that in the EU+12 countries all transport construction projects of similar European Added Value situated on Priority Project axes will receive the necessary support from the structural funds (managed by DG Regional Policy) and not from the TEN-T multi annual programme. .

In reality it is of course completely at the discretion of each Member State to which budget line it applies for Community support.

5.2.2 Speeding-up element

One of the key questions to be answered in this evaluation is whether (a type of) focussed TEN-T support, to be operationalised by above mentioned policy options, could speed-up the realisation of the total TEN-T network. This element is split into two mechanisms:

- The time gains realised on a particular section of a priority axis. The support from the MAP TEN-T could actually provide the last "push into the right direction" in order to make a project happen. It shows that the Commission is serious about the European dimension of particular projects.
- The wider time gains because a particular section of a priority axis is realised. It is envisaged that the realisation of a whole corridor/axis is also accelerated because one section is carried out.

The High Level Group[38] considers that the label of "priority project" leading to the coordination and concentration of Community financial resources must also lead to increased financial contributions of the States and local authorities allocated to the trans-European transport network. This label must also serve as a reference for the loan policy of the European Investment Bank. The Group thinks that this label, thanks to suitable legal structures, will help to attract private investors. Increased funds must in turn lead to a speeding-up of projects.

[35] Common Position adopted by the Council on 22 March 2007 with a view to the adoption of a Regulation of the EP and of the Council laying down general rules for the granting of Community financial aid in the field of the trans-European transport and energy networks (The new "TEN Regulation 2007-2013")

[36] See for instance: Report of the Court of Auditors on the TEN-T Programme (2007)

[37] Portugal, Spain and Greece are also eligible for the Cohesion Fund. It is likely that these countries will not meet the eligibility criteria on GDP level anymore somewhere during the programming period 2007-2013. Therefore, it is assumed that the MAP TEN-T will be used for works in Portugal, Spain and Greece.

[38] Final report of the High level group on the Trans-European Transport network (2003).

Although there are several reasons for TEN-T projects to be delayed, the financing issues are often one of the (main) reasons. For example financial uncertainties may lead to a delay in the completion of sections in the railway line/road Ireland-United Kingdom-Continental Europe. The same is true for the railway line Prague-Nuremberg. On the other hand, the Belgium railways are currently studying the feasibility of creating a PPP construction to speed up the 'Eurocaprail' (Brussels-Luxembourg-Strasbourg railway line), i.e. additional private funds are expected to lead to speeding-up of the project.

Different sources[39] have been studied to seek for evidence on the impact of the availability of sufficient financial sources on the speed of implementation of transport infrastructure. The typical delay in implementation is found to be 1-2 yrs; however 30% of cases show a delay of more than 2 years. It proved to be impossible to isolate the financial aspect from other aspects causing delays in implementation, like poor project preparation, lack of (cross national) cooperation etc. Basically it is assumed that by assuring sufficient financial sources, the speeding-up of the implementation of the infrastructure could differ between 0 and 20 years. The latter acceleration could occur in case of a cross-border project for which the Member States involved do not show any interest. Then, a significant EU financial grant could actually lead to much earlier implementation.

During the stakeholder consultation (chapter 4) this acceleration effect was also discussed. The stakeholder consultation gave rise to the following assumptions on the acceleration effects:

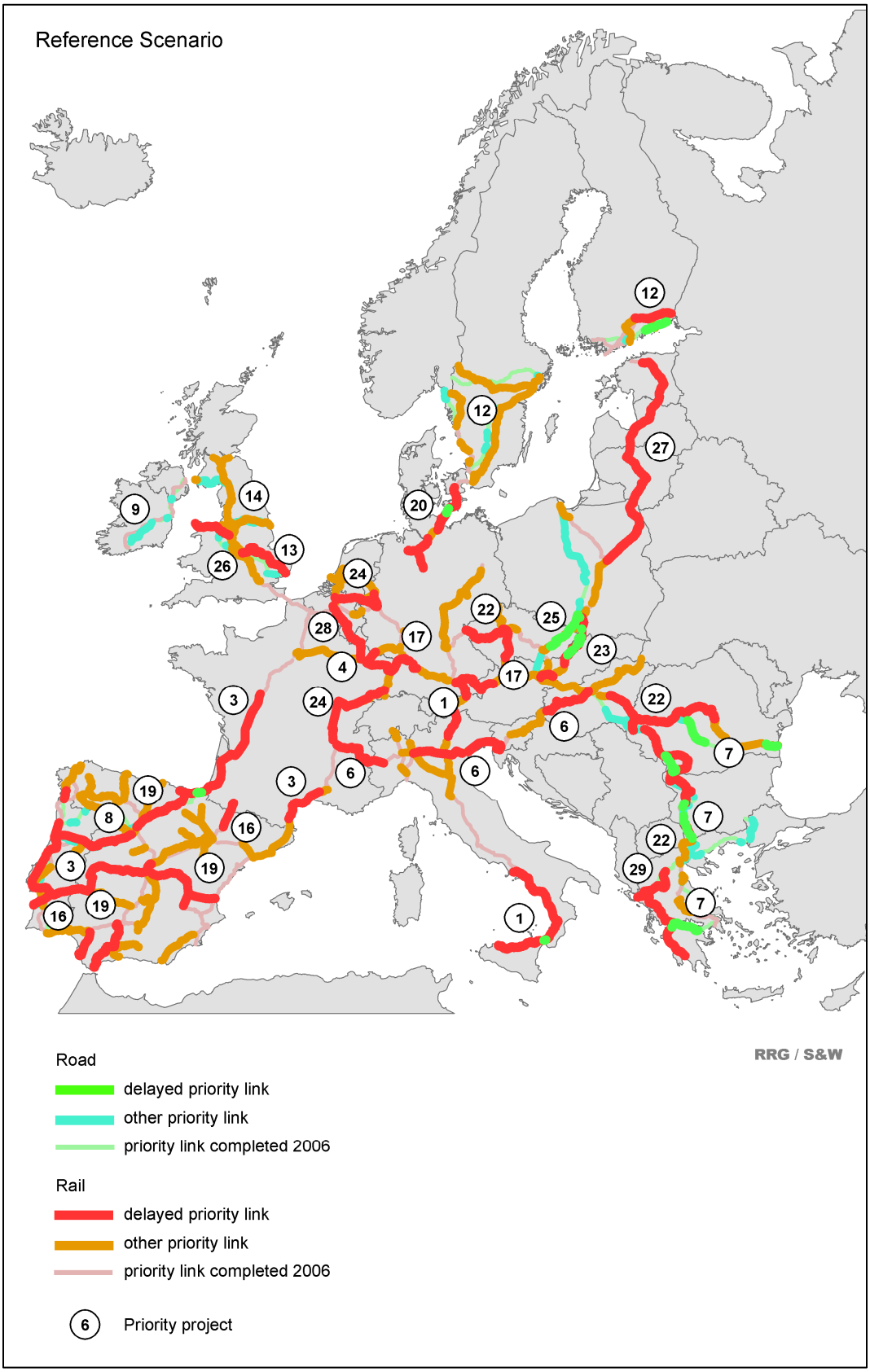
- Cross-border projects will be on average realised **3 years** earlier in case the TEN-T budget made available equals 30% of the eligible construction costs.
- For bottleneck sections, the average speeding-up is assumed to be **2 years**, because these sections are, according to the definition used in this study, situated on the territory of only one Member State. The national interests are larger compared to cross-border projects and thus it will be easier to engage national budgets.
- The wider time gains for the whole corridor are estimated to be somewhat less compared to the figures for the specific sections: only **1 year**.

Since the variation in acceleration effect is expected to be rather high, it is important to test the sensitivity of these assumptions on the economic, environmental and social impacts (chapter 6). Therefore, the impacts of **5 year** earlier realisation of Cross-border project and only **1 year** for Bottleneck projects and unchanged assumptions for the wider time gains in the whole corridor have also been analysed.

The effect of the speeding-up element is to be assessed by means of realising the benefits (accessibility, environment, employment etc.) of the TEN-T network earlier than without the TEN-T financing. It is known that the implementation of TEN projects in the past has

[39] E.g. "Megaprojects and risk, An anatomy of ambition", B. Flyvbjerg 2003, ISBN 0521009464, ""Ex-post evaluation of a sample of projects co-financed by the Cohesion Fund in 1994-2002"'on behalf of DG Regional Policy, 2004, ECORYS

Figure 5.1 TEN-T priority projects in the Reference Scenario



caused (serious) delays[40]. Therefore, rather than bringing the realisation of projects 3 or 2 years earlier in time compared to the most recent timetables provided in the TEN-T implementation report 2005[41], it has been decided to use for each policy option a **reference scenario** in which the starting year of operations for all projects is delayed with 3 year for cross-border sections and 2 years for bottleneck sections.
In the actual policy option, the acceleration element is included.

This means that in both the reference situation and the focussed TEN-T support situation the same projects will be realised. The difference between the two situations is that only in the focussed TEN-T support situation a number of projects (depending on the policy options) will be realised some years earlier (the acceleration effect).

The figure on the previous page provides a geographical representation of the TEN-T priority projects. A distinction is made between delayed priority projects, implemented priority projects as per 2006 and other priority projects which are presently under construction.

5.3 Option 1 "Corridor concept"

The philosophy of the "corridor concept" is to promote investment in missing parts of the priority TEN-T corridors.

Selection criteria
The selection of projects within this policy option is done by starting from the defined priority axes/projects and applying a multi-criteria analysis in which the following criteria are used:

- Travel time savings per passenger [mln hours per year]. This indicator is expressed in time saved due to improved transport connections.
- Passenger traffic flows [passengers per year]. This represents the estimated number of passengers per year, providing an indicator for the weight of the bottleneck.
- Freight traffic flows [ton-km per year]. The freight transport flows are expressed in ton-km per year.

Each criterion is equally weighted in the multi-criteria analysis.

It is noted that these criteria do not well enough reflect the element of completing a corridor since all sections are assessed separately. Clearly, there is a need to assess sections together as well, meaning that two sections that complement a corridor should be scored higher compared to one single section.

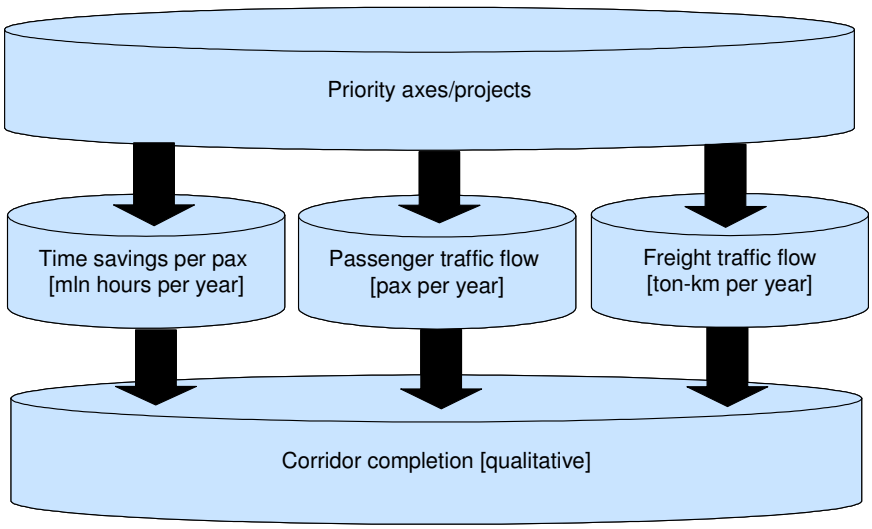
Therefore, a second step in the selection has been introduced. Each tentatively selected project was judged on whether it was part of a corridor or rather a "stand-alone" section.

[40] It is envisaged that the ex-post evaluation MIP TEN-T 2001-2006 will provide more details on the cost and time overruns.
[41] Besides, this could cause problems in case a project is scheduled to be in operation by say 2010. Bringing it 2 year earlier in time would mean that the project would already be ready in 2008, which in most cases is not realistic (e.g. Priority project 7 section Sofia-Kulata-Greek/Bulgarian border is scheduled to be ready by 2010).

In case a project was stand alone (e.g. the Dax-Bordeaux rail line) the connecting sections were added (Bordeaux-Tours and Irun/Hendaye-Dax). This was done for most stand-alone sections, however for some it appeared that the connecting sections scored very low on the initial ranking. It that case it was decided to delete that project (e.g. the Messina bridge initially scored rather high mainly because of high traffic forecasts, but the connection section Napels-Messina scored very low, and therefore the Messina bridge was deleted).

It is known that each priority axis in the TEN-T network is divided into certain projects of which some are indicated as non-priority sections[42]. However, in order to realise the full benefits of the corridor, obviously all sections need to be implemented. Therefore this distinction is not used in the selection process for this option. The values for the criteria have all been based on the TEN-STAC study.

The next figure presents the steps of the selection process under this option.



Applying the above selection criteria results in the following projects for option 1:

[42] As defined in the report "TEN-T priority axes and projects 2005"

Table 5.1 Selected projects in **minimum** (number of projects) scenario Policy Option 1 "Corridor concept"

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Irún/Hendaye - Dax	3	Rail	Upgrade	30%	2015
Dax - Bordeaux	3	Rail	New	20%	2020
Bordeaux - Tours	3	Rail	New	10%	2015
Milan - Padova	6	Rail	New	20%	2011
Lyon - Torino	6	Rail	New	30%	2018
Stuttgart - Ulm	17	Rail	New	20%	2012
Salzburg - Vöcklabruck	17	Rail	Upgrade	10%	2012
Munich - Salzburg	17	Rail	Upgrade	30%	2015
Baudrecourt - Strasbourg - Kehl	17	Rail	New	30%	2015
Prague - Nuremberg	22	Rail	Upgrade	30%	2016
Rheidt - Antwerp	24	Rail	Upgrade	30%	2010

As mentioned, through lowering the MAP TEN-T co-financing rate, an additional number of projects can be funded. The following additional projects can be co-financed in the maximum scenario:

Table 5.2 Additional selected projects in **maximum** (number of projects) scenario Policy Option 1 "Corridor concept"

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Munich-Kufstein	1	Rail	New	15%	2015
Brenner Tunnel	1	Rail	New	15%	2015
Perpignan - Montpellier	3	Rail	New	10%	2009
Montpellier - Nimes	3	Rail	New	10%	2015
Venezia - Ronchi Sud - Triest - Divaca	6	Rail	New	15%	2015
Puttgarden - Hamburg	20	Rail	Upgrade	10%	2014
Rodby - Puttgarden	20	Rail - road link	New	15%	2015
Hannover - Hamburg / Bremen	20	Rail	Upgrade	10%	2015
Lyon - Mulhouse - Müllheim	24	Rail	New	15%	2018
Brussels - Luxembourg border	28	Rail	Upgrade	10%	2012
Luxembourg - French border	28	Rail	Upgrade	10%	2013

Note: The co-financing rate for the selected projects in table 5.1 has been decreased in the maximum scenario.

A detailed analysis on this selection is provided in annex 2 of this study.

Figure 5.2 Network projects, Corridor scenarios

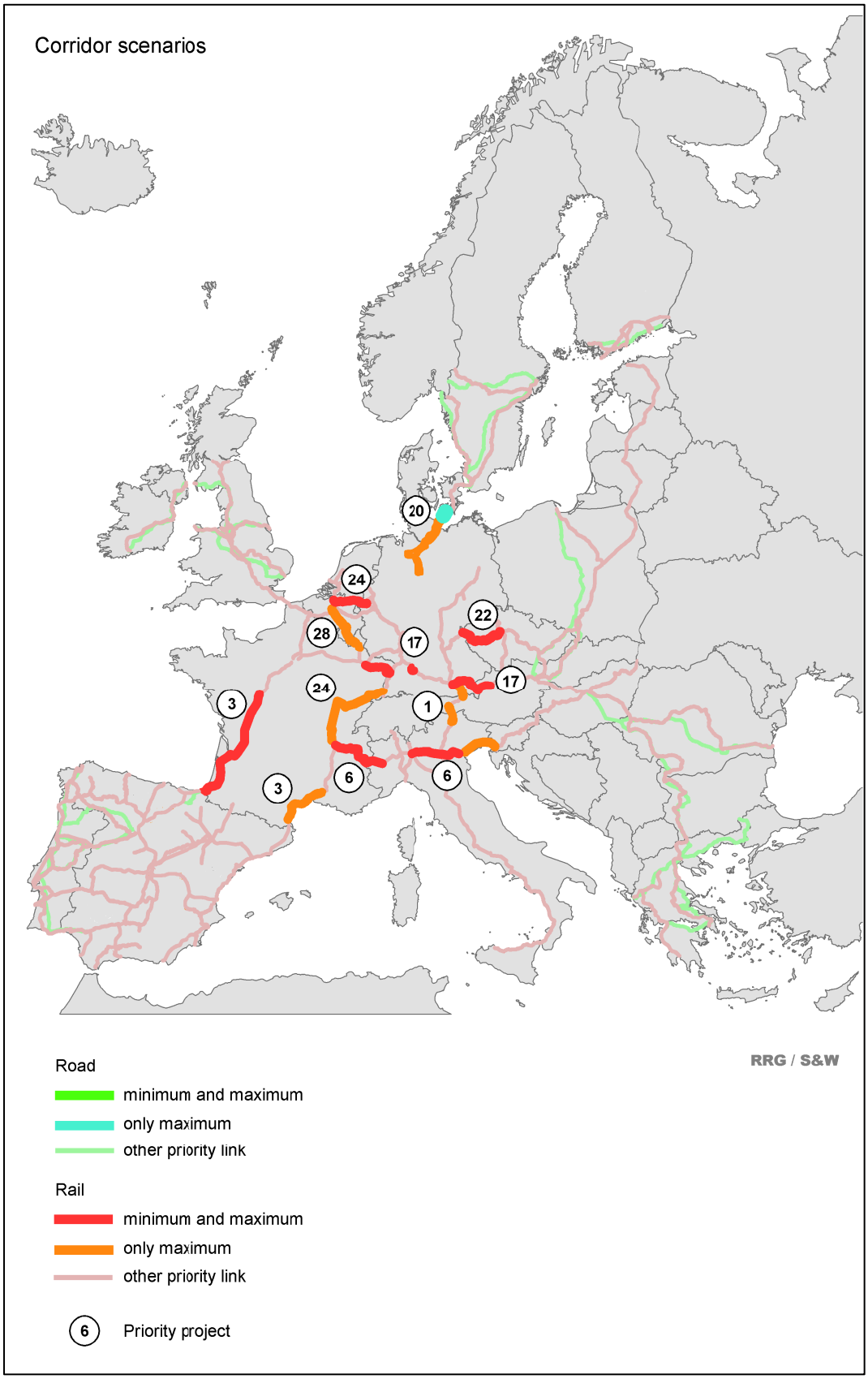


Figure 5.2 on the previous page shows the network project selected for the Corridor option[43]. The map shows the selected projects as heavy lines with the numbers of the TEN priority projects. The thin lines indicate other sections of TEN priority projects not selected for this policy option. Selected road links are shown in green and blue and selected rail links in red and orange. In the maximum scenario all projects indicated by heavy lines are selected. In the minimum scenario only the red and green projects are selected.

One can see that the selected projects are focused on the major transport corridors in the core of Europe. With the exception of the railway between Nuremberg and Prague, no projects in the new member states are represented. This is because the transport investments of the Structural and Cohesion Funds are not included in this study.

Another observation is the lack of projects selected in Spain, Portugal, the UK, Austria and Greece. This is mainly due to rather low passenger and/or freight transport forecasted traffic in relation to the selected projects.

5.4 Option 2 "Cross-border focus"

In this option, the MAP TEN-T budget is solely dedicated to sections which involve at least two Member States.

Cross-border projects

The specific problem here is that missing cross-border links do in general not have priority from the perspective of the Member State on whose territory the missing link is located. Without the support from the MAP these projects will face serious delays or might even not be put forward by the respecting Member States because there is no shared interest.

Motorways of the Sea

The Motorways of the Sea projects do also belong to the group of cross-border projects. These projects are separately assessed within this policy option, since the impact of these projects can not be modelled (see section on analysis of impacts).

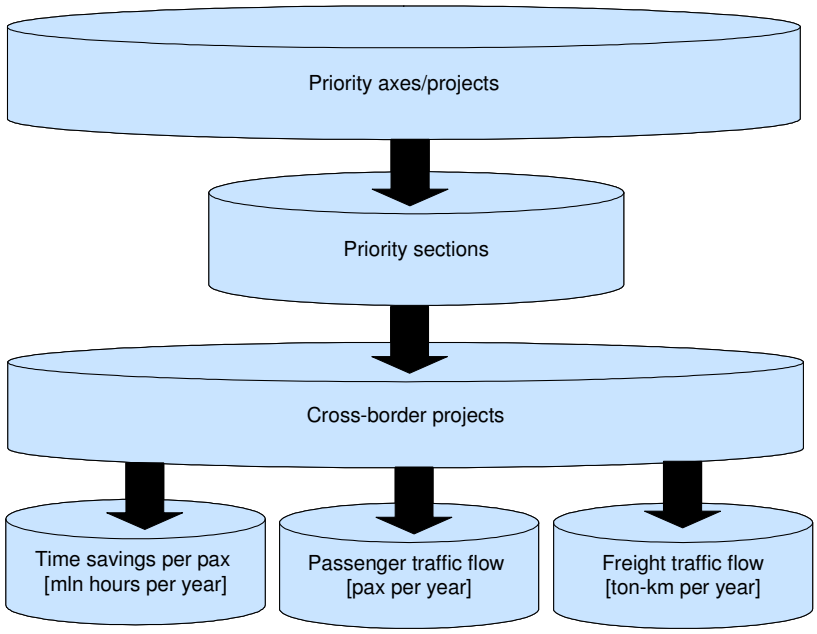
Selection criteria

The same selection criteria as compared to the option 1 "corridor concept" are applied (i.e. travel time savings passengers, passenger traffic flows and freight traffic flows). In addition, only priority sections of projects are selected.

Each criterion is equally weighted in the multi-criteria analysis.

The next figure presents the sequential steps of the selection process under this option.

[43] As geocoded by RRG Spatial Planning and Geoinformation



Applying the above selection criteria results in the following projects for each policy option:

Table 5.3 Selected projects in **minimum** (number of projects) scenario Policy Option 2 – cross-border

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Munich-Kufstein	1	Rail	Upgrade	30%	2015
Irún/Hendaye - Dax	3	Rail	Upgrade	30%	2015
Lyon - Torino	6	Rail	New	30%	2018
Venezia - Ronchi Sud - Triest - Divaca	6	Rail	New	30%	2015
Munich - Salzburg	17	Rail	Upgrade	30%	2015
Baudrecourt –Strasbourg-Kehl	17	Rail	New	30%	2015
Rodby - Puttgarden	20	Rail - road	New	30%	2015
Rheidt - Antwerp	24	Rail	Upgrade	30%	2010
Lyon - Mulhouse - Müllheim	24	Rail	New	30%	2018

The following additional projects can be co-financed in the maximum scenario, as a result of reducing the co-financing rate:

Table 5.4 Additional selected projects in **maximum** (number of projects) scenario Policy Option 2 – cross-border

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Brenner Tunnel	1	Rail	New	15%	2015
Lisbon - Madrid	3	Rail	new	15%	2013
Aveiro - Salamanca	3	Rail	new	15%	2015
Baudrecourt - Luxemburg	4	Rail	New	15%	2010
Sines - Badajoz	16	Rail	New	15%	2010
Rhine - Meuse	18	Waterway	Upgrade	15%	2019
Vienna - Bratislava	18	Waterway	Upgrade	15%	2015

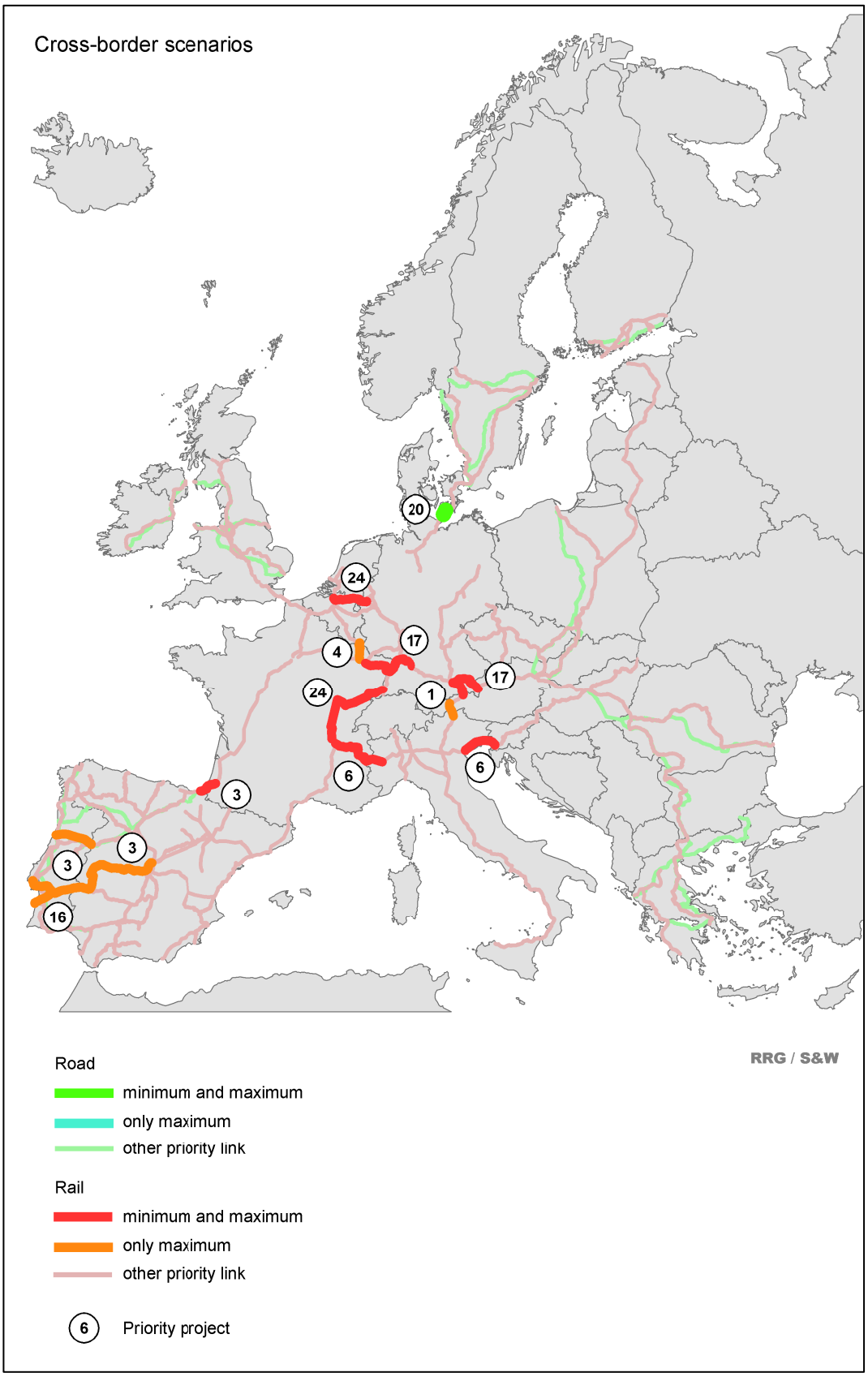
Note: The co-financing rate for the selected projects in table 5.3 has been decreased in the maximum scenario.

A detailed analysis on this selection is provided in annex 2 of this study.

Figure 5.3 on the following page shows the network project selected for the Cross-border scenarios.

The selected cross-border links and the corresponding access sections are again concentrated on inner-European borders in the core of Europe between Austria, Belgium, Denmark, France and Germany, with the addition of cross-border links between Spain and Portugal and France. The only cross-border link to a new member state is the connection between Trieste in Italy and Divaca in Slovenia.

Figure 5.3 Network projects, Cross-border scenarios



5.5 Option 3 “Bottleneck focus”

In this option, the MAP TEN-T is solely dedicated to bottleneck sections which are located on the territory of one Member State. It could be that such a (national) bottleneck section is a missing link in an international corridor.

Bottleneck projects

A bottleneck means an obstacle in terms of speed and capacity which makes it impossible to guarantee the continuity of transport flows, in particular in the framework of priority projects. By definition bottlenecks result in negative economic effects (i.e. transport is less efficient compared to the situation in which the bottleneck does not exist). Taking away the bottleneck will result in more efficient transport (i.e. travel time savings). In general it is envisaged that national bottlenecks will have priority from the perspective of the respective Member State. Therefore, normally bottleneck projects will mainly be financed from national budgets. However there are also occasions in which the interest of the Member State might be lower due to other priorities and the international importance of the corridor is not acknowledged.

It is important to notice that financial support by the MAP TEN-T might only (slightly) speed up the process of bottleneck projects, because without this support bottleneck projects will be financed anyway from national budgets (or in the case of the new Member States mainly by the Cohesion fund).

Selection criteria

The same selection criteria as compared to the option 1 “corridor concept” are applied (i.e. travel time savings passengers, passenger traffic flows and freight traffic flows). However, in this case only priority sections of projects are selected. Each criterion is equally weighted in the multi-criteria analysis. The next figure presents the sequential steps of the selection process under this option.

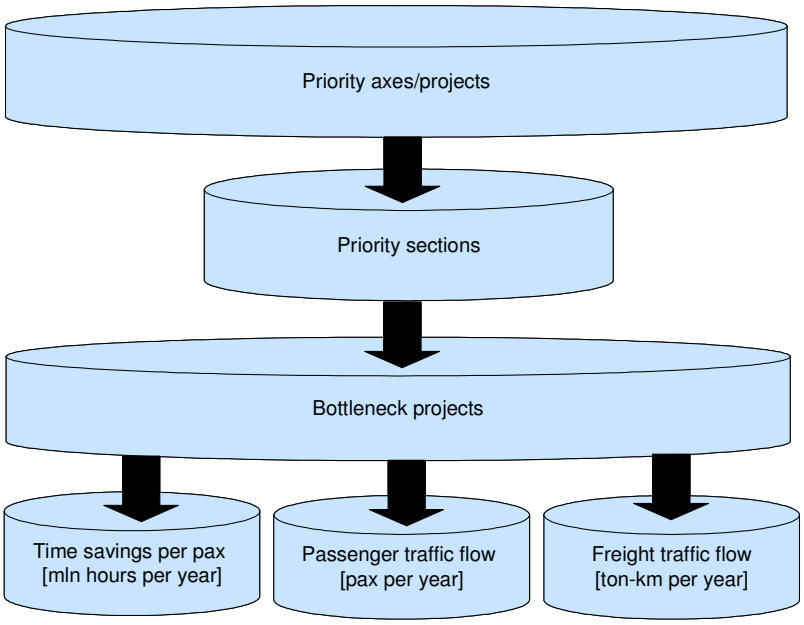


Table 5.5 Selected projects in **minimum** (number of projects) scenario Policy Option 3 – bottlenecks

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Rail / road bridge over the Strait of Messina - Palermo	1	Rail/Road	New	20%	2015
Dax - Bordeaux	3	Rail	New	20%	2020
Bordeaux - Tours	3	Rail	New	20%	2015
Perpignan - Montpellier	3	Rail	New	20%	2009
Lisbon - Porto	3	Rail	new	20%	2015
Montpellier - Nimes	3	Rail	New	20%	2015
Milan - Padova	6	Rail	New	20%	2011
Patras - Korinthos	7	Road	Upgrade	20%	2008
Fuentes de Onora - Medina del Campo	8	Rail	Upgrade	20%	2015
Pontevedra - Viana do Castelo	8	Rail	Upgrade	20%	2009
Lahti - Vainikkala	12	Rail	New	20%	2015
Koskenilä - Vaalima	12	Road	Upgrade	20%	2015
Stuttgart - Ulm	17	Rail	New	20%	2012
Puttgarden - Hamburg	20	Rail	Upgrade	20%	2014
Hannover - Hamburg / Bremen	20	Rail	Upgrade	20%	2015
Rodby - Oresund	20	Rail	Upgrade	20%	2015
Brussels - Luxembourg border	28	Rail	Upgrade	20%	2012
Luxembourg - French border	28	Rail	New	20%	2013
Ioannina - Antirío - Río - Kalamata	29	Rail	New	20%	2014
Kozani - Kalambaka - Igoumenitsa	29	Rail	New	20%	2012

The following additional projects can be co-financed in the maximum scenario:

Table 5.6 Additional selected projects in **maximum** (number of projects) scenario Policy Option 3 – bottlenecks

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Algeciras - Bobadilla	16	Rail	New	10%	2010
Straubing - Vilshofen	18	Waterway	Upgrade	10%	2013
Palkovicovo - Mohács	18	Waterway	Upgrade	10%	2014
Cambrai - Compiègne	30	Waterway	New	10%	2016

Note: The co-financing rate for the selected projects in table 5.5 has been decreased in the maximum scenario.

A detailed analysis on this selection is provided in annex 2 of this study.

Figure 5.4 Network projects, Bottleneck scenarios

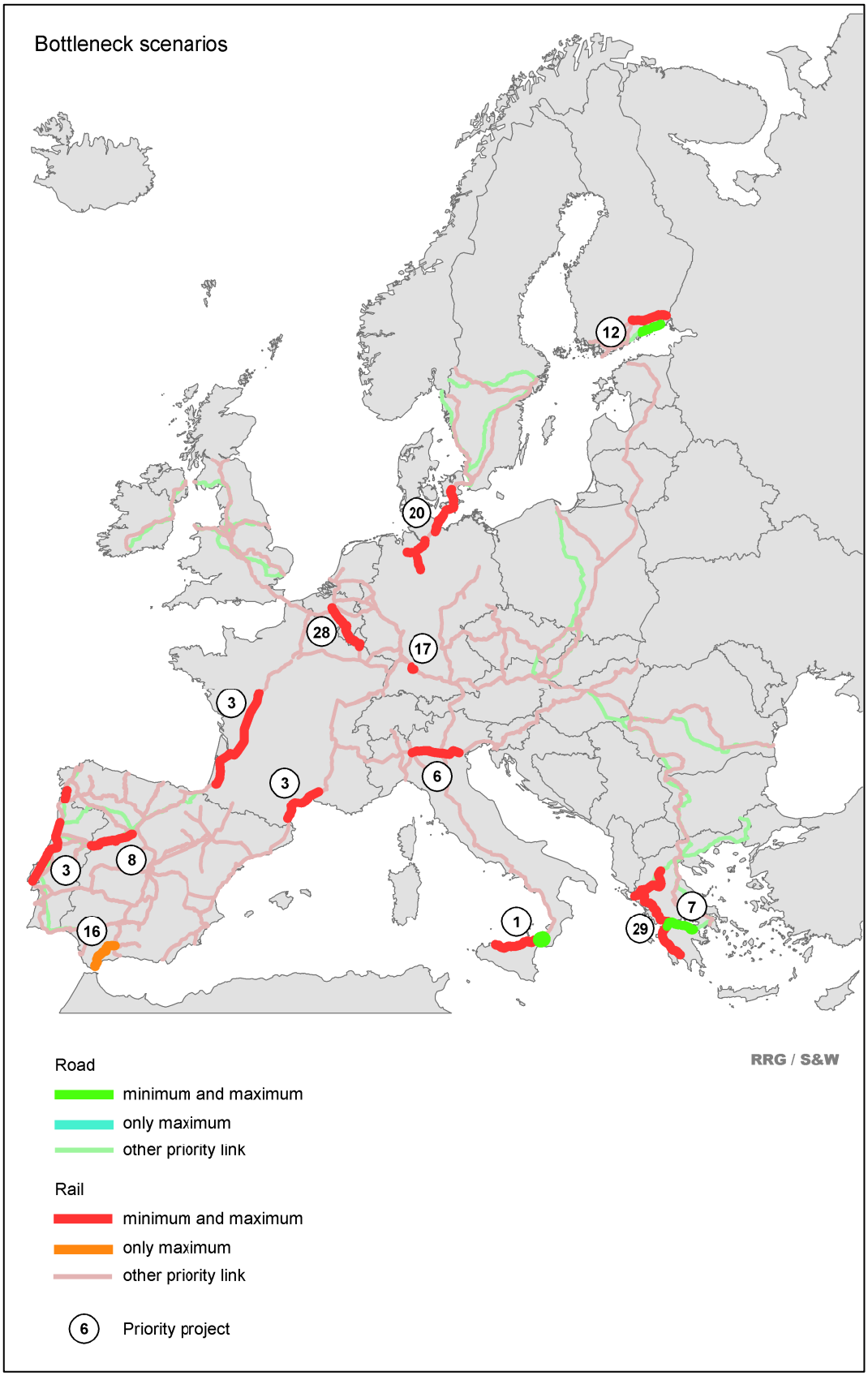


Figure 5.4 on the previous page shows the network project selected for the Bottleneck scenarios. Based on the results of the TEN-STAC project, the selected projects of this policy option are more widely distributed across the countries of Europe than in the Corridor and Cross-border scenarios. This is the only group of scenarios in which also projects in Greece are selected. The two bridges across the Fehmarn Belt and the Straits of Messina are selected and no projects in the new member states are selected.

Another observation is the lack of projects selected in the UK and Austria. This is mainly due to rather low passenger and/or freight transport predicted traffic in relation to the selected projects.

5.6 Option 4 "European Added Value"

This policy option includes any project of high European Added Value situated on the TEN-T priority axis.

European Added Value

The term European Added Value (EAV) is not clearly defined but in most EU sources it is closely related to subsidiarity. Added value is then the additional benefit arising from Community action that could not be achieved by one individual country alone. In the context of the TEN-T this refers specifically to cross-border projects.

If this definition of European Added Value of TEN-T projects is adopted, a suitable indicator of the EAV of a project would be its **European or cross-border effects**, i.e. all effects occurring not in the country in which the project is located but in adjacent or even far-away countries, either in absolute terms or as a percentage of its overall impact.

The above definition does not take into account two main elements of the European transport and regional policy. First of al the aspect of **sustainability** through e.g. promoting multi-modality, as laid down in the Common Transport Policy, is not addressed. Clearly, if priority rail and road corridors are connected to sea ports, added value could be created though the Motorways of the Sea concept.

Secondly, the **social cohesion** policy of the Commission also reflects European added value and should be taken into consideration. Developing the transport infrastructure in Europe is seen as one of the key factors in stimulating economic development and integrating countries in the European Union.

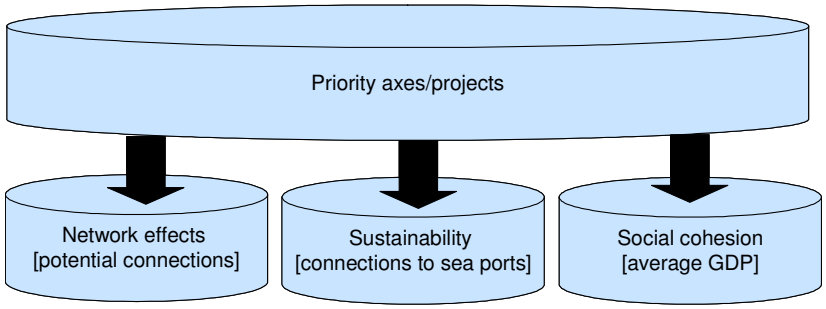
In summary, it is concluded that European added value is composed of different dimensions and can not be captured in only one indicator. Therefore, in the framework of this study, it has been decided to use the above mentioned elements.

Selection criteria

The selection of projects within this policy option is done by starting from the defined priority axes/projects and applying a multi-criteria analysis in which the following criteria are used:

- Network effects [number of potential connections of the project with other priority axes and of the axe with other priority axes].
- Sustainability [rail/inland waterway corridor connected to sea ports]. The sustainability is directly related to promoting intermodal transport.
- Social cohesion [location within poorer region in EU].

Each criterion is equally weighted in the multi-criteria analysis.
The next figure presents the sequential steps of the selection process under this option.



Applying the above selection criteria results in the following projects for the European Added Value option:

Table 5.7 Selected projects in **minimum** (number of projects) scenario Policy Option 4 – high European added value

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Rail / road bridge over the Strait of Messina - Palermo	1	Rail/Road	New	20%	2015
Napels - Messina	1	Rail	Upgrade	20%	2020
Lisbon - Madrid	3	Rail	New	30%	2013
Lisbon - Porto	3	Rail	New	20%	2015
Aveiro - Salamanca	3	Rail	New	30%	2015
Irún/Hendaye - Dax	3	Rail	Upgrade	30%	2015
Sines - Badajoz	16	Rail	New	30%	2010
Algeciras - Bobadilla	16	Rail	New	20%	2010
Vienna - Bratislava	17	Rail	Upgrade	30%	2012
Baudrecourt – Strasbourg – Kehl	17	Rail	New	30%	2015
Vienna - Bratislava	18	Waterway	Upgrade	30%	2015
Rhine - Meuse	18	Waterway	Upgrade	30%	2019
North-east corridor	19	Rail	New	20%	2020
Madrid - Levante and Mediterranean	19	Rail	New	20%	2020
Prague - Nuremberg	22	Rail	Upgrade	30%	2016
Prague - Linz	22	Rail	Upgrade	30%	2017
Rheidt - Antwerp	24	Rail	Upgrade	30%	2010
Köln-Rheidt and Köln-Duisburg	24	Rail	Upgrade	20%	2013

The following additional projects can be co-financed in the maximum scenario:

Table 5.8 Additional selected projects in **maximum** (number of projects) scenario Policy Option 4 – high European added value

Project/section	Priority axis	Transport mode	Upgrade or New	Co-financing rate	Year of completion
Dax - Bordeaux	3	Rail	New	10%	2020
Bordeaux - Tours	3	Rail	New	10%	2015
Lyon - Torino	6	Rail	New	15%	2018
Milan - Padova	6	Rail	New	10%	2011
Munich - Salzburg	17	Rail	Upgrade	15%	2015
Stuttgart - Ulm	17	Rail	New	10%	2012
Salzburg - Vöcklabruck	17	Rail	Upgrade	10%	2012
Lyon - Mulhouse - Müllheim	24	Rail	New	15%	2018

Note: The co-financing rate for the selected projects in table 5.6 has been decreased in the maximum scenario.

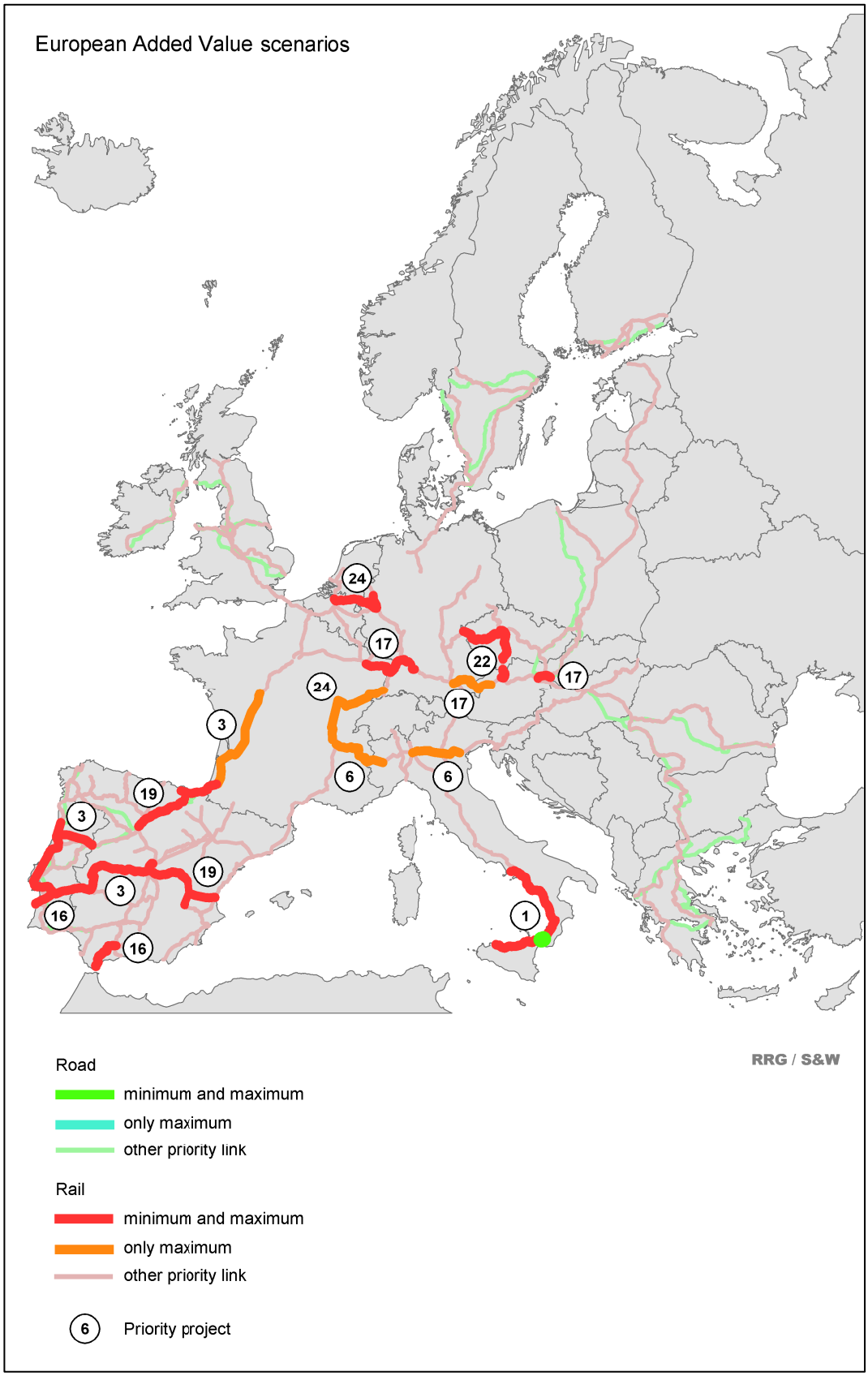
A detailed analysis on this selection is provided in annex 2 of this study.

Figure 5.5 on the following page shows the network project selected for the European Added Value scenarios.

There is a remarkable concentration on rail projects in Spain and Portugal in this policy option as well as many cross-border links of the Cross-border scenarios. The bridge across the Straits of Messina and access links is represented, but not the Fehmarn Belt bridge. The new member states are served by upgraded rail connections between Prague and Nuremberg and Linz and between Vienna and Bratislava.

Another observation is the lack of projects selected in the UK and Greece. This is mainly due to rather low scores on network effects and sustainability in relation to the selected projects.

Figure 5.5 Network projects, European Added Value scenarios



6 Analysis of impacts

6.1 Introduction

The assessment of the impacts is the most important element of this study. Impacts can be identified in various domains, *in casu*: economic, competitiveness, social and environmental impacts. In assessing the impacts the full list of possible impacts as identified in the *Impact Assessment Guidelines* will be considered.

However, as is also stated in the *Impact Assessment Guidelines*, the principle of proportionate analysis should be applied. This implies that the analysis should *focus on the most significant impacts and distributive effects* and the depth of the analysis has to match the significance of the impacts.

6.2 Overview of expected impacts

The relevant impacts of the proposed directive are expected to be:

- *Economic impacts (including competitiveness)*:
  - Transport infrastructure investment
  - Public-Private-Partnerships
  - Travel time savings (passengers)
  - Transport cost savings (freight)
  - Accessibility
  - Competitiveness
  - Territorial cohesion and regional development
  - Congestion levels
  - Modal shift
  - Interoperability and interconnection of national networks

- *Environmental impacts*:
  - Emissions (NOx and particulates)
  - Climate (reduction of CO_2)

- *Social impacts*:
  - Employment
  - Innovation
  - Safety (accidents)
  - Security

- Human resources and administrative costs[44]

The impacts are assessed by calculated the difference between the reference scenario (with on schedule implementation of TEN-T projects) and the policy options (with accelerated implementation).

6.3 Methodology of assessment

The assessment of the importance and direction of the impacts is based on desk research and results from the stakeholder consultation. Most of the impacts are determined through existing sources, most importantly the work carried out in the TEN-STAC study.

An additional modelling exercise has been carried out using the SASI model[45] to assess the macro-economic impacts (GDP growth) and territorial cohesion impacts. The SASI model is specifically relevant for projects that serve a function on a European level (e.g. the TEN projects). Such projects cannot be adequately evaluated using traditional cost-benefit analysis on a national scale, since such analysis is less able to capture the international effect and the indirect effects occurring in non-transport sectors[46].

The SASI model forecasts socio-economic impacts (economy, population, migration) of a wide range of transport policies on NUTS-3 regions for every year until a forecasting horizon. It contains a detailed transport network database and can therefore model the impacts of individual transport infrastructure projects. However, it does not model transport flows.

The forecasted transport flows are needed in order to assess the network effects of the policy options. Therefore, the transport flows as forecasted by the TEN-STAC study has been used to complement the impact assessment.

6.4 Economic impacts

6.4.1 Transport infrastructure investment

A contribution by the EU to the realisation of TEN-T projects implies that (substantial) contributions from national governments are needed, since the MAP TEN-T budget allocated to works co-finances only a part of the TEN-T projects (see section 4.2). This means that when a relatively large part of the TEN-T projects in one of the envisaged policy options is planned in one country this can impose a (too) high burden on

[44] The creation of a TEN executive agency in the beginning of 2007 is taken into account

[45] The SASI model is a recursive-dynamic simulation model of socio-economic development of 1330 regions in Europe. The model was developed to assess socio-economic and spatial impacts of transport infrastructure investment and transport system improvements. It has been applied and validated in several large EU projects including the IASON and ESPON projects

[46] See e.g. Rothengatter, The relevance of Transeuropean Transport Networks for Integration and Growth in the Extended European Union.

government finances. This in turn can impose a barrier for the actual implementation of the selected policy option.

In the next two tables the total contribution needed from national Governments, EIB loans and private sources of finance through PPP in the period 2007-2013 for each policy option (table 6.1) as well as the yearly contribution during the same period (table 6.2) is shown[47].

The contributions needed in the maximum scenarios are above the levels in the minimum scenarios because in the maximum scenarios more projects are selected and the contribution from the EU to each of the individual projects is lowered. The total contribution of all other sources of finance in the period 2007-2013 varies between 12.4 billion Euro (Cross Border-minimum) and 38.8 billion Euro (European Value Added-maximum), i.e. an average of 2.1 – 6.5 billion Euro each year.

Table 6.1 Total contribution needed of national Governments, EIB loans and PPPs for TEN-T priority projects in the different policy options, period 2007-2013 (in million Euro)

Country	Corridor concept		Cross-border focus		Bottleneck focus		European Value Added	
	Min	Max	min	Max	min	max	min	max
Austria	1,190	2,950	130	1,760	-	-	340	1,550
Belgium	90	940	90	180	750	840	150	180
Denmark	-	1,500	930	1,130	320	360	-	-
Finland	-	-	-	-	870	970	-	-
France	5,190	9,080	4,200	6,340	4,340	6,050	270	8,860
Germany	1,410	5,110	1,820	2,220	1,800	2,120	1,060	2,130
Greece	-	-	-	-	1,480	1,670	-	-
Hungary	-	330	270	350	-	200	-	-
Italy	7,060	12,320	4,610	7,120	6,660	7,490	5,420	13,030
Luxembourg	-	100	-	-	90	100	-	-
The Netherlands	90	100	90	250	-	-	150	180
Portugal	-	-	-	1,920	1,740	1,960	3,470	4,070
Slovenia	-	330	270	350	-	-	10	20
Spain	20	30	20	2,420	380	690	7,210	8,010
Czech republic	360	440	-	-	-	-	700	790
Total	15,410	33,230	12,430	24,030	18,420	22,450	18,780	38,820

[47] Ideally an estimation should be made of the Government funds, EIB loans and PPP sources separately. However, data to perform this analysis was not available on project level.

Table 6.2 Yearly contribution on average needed from Governments, EIB loans and PPPs for TEN-T priority projects in the different policy options, period 2007-2013 (in million Euro)

Country	Corridor concept		Cross-border focus		Bottleneck focus		European Value Added	
	Min	Max	min	Max	min	max	min	max
Austria	200	490	20	295	-	-	55	260
Belgium	15	155	15	30	125	140	25	30
Denmark	-	250	155	190	55	60	-	-
Finland	-	-	-	-	145	160	-	-
France	865	1,510	700	1,055	725	1,010	45	1,475
Germany	235	850	305	370	300	355	175	355
Greece	-	-	-	-	245	280	-	-
Hungary	-	55	45	60	-	35	-	-
Italy	1,175	2,055	770	1,185	1,110	1,250	905	2,170
Luxembourg	-	15	-	-	15	15	-	-
The Netherlands	15	15	15	40	-	-	25	30
Portugal	-	-	-	320	290	325	580	680
Slovenia	-	55	45	60	-	-	5	5
Spain	5	5	5	405	65	115	1,200	1,335
Czech republic	60	75	-	-	-	-	115	130
Total	2,570	5,540	2,075	4,010	3,075	3,745	3,130	6, 470

As a comparison to the average contribution needed from other sources, the next table provides 2001 figures on the total public budget contributions in the EU+15, Switzerland and Norway, and the share of payments for capital investment. This comparison is made, since it is expected that the national budgets will need to finance the majority of the amount mentioned in the previous table.

In 2001 the estimated payment for capital investment in rail infrastructure by the Italian authorities amounted to € 3.6 billion. According to figures of EIM[48] the Italian rail infrastructure manager invested € 6.5 billion in 2005. As a contribution to the implementation of TEN-T projects a maximum yearly average of around € 2.2 billion is needed in the period 2007-2013, which is 60% of the total rail infrastructure capital investments in 2001 and around 33% of total rail infrastructure investments in 2005. The needed yearly contribution of Spain to TEN-T projects in the European Value Added scenario is around the total public budget contribution to railways in 2001.

[48] European Rail Infrastructure Managers (EIM), The journey to the future is a European railway system open to all.

Table 6.3 Estimated public budget contributions to railways 2001 (in million Euros)

Countries	Total public budget contributions (in million EUR)	Of which payments for capital investment (in million EUR)
AT	1,917	122
BE	1,957	419
CH	2,565	599
DE	9,040	2,649
DK	861	114
ES	1,401	
FI	431	61
FR	6,876	263
GB	2,985	
GR	1,079	507
IE	322	176
IT	7,928	3,615
LU	218	
NL	2,273	1,224
NO	734	174
PT	103	87
SE	897	419
EU+15	38,288	9,657

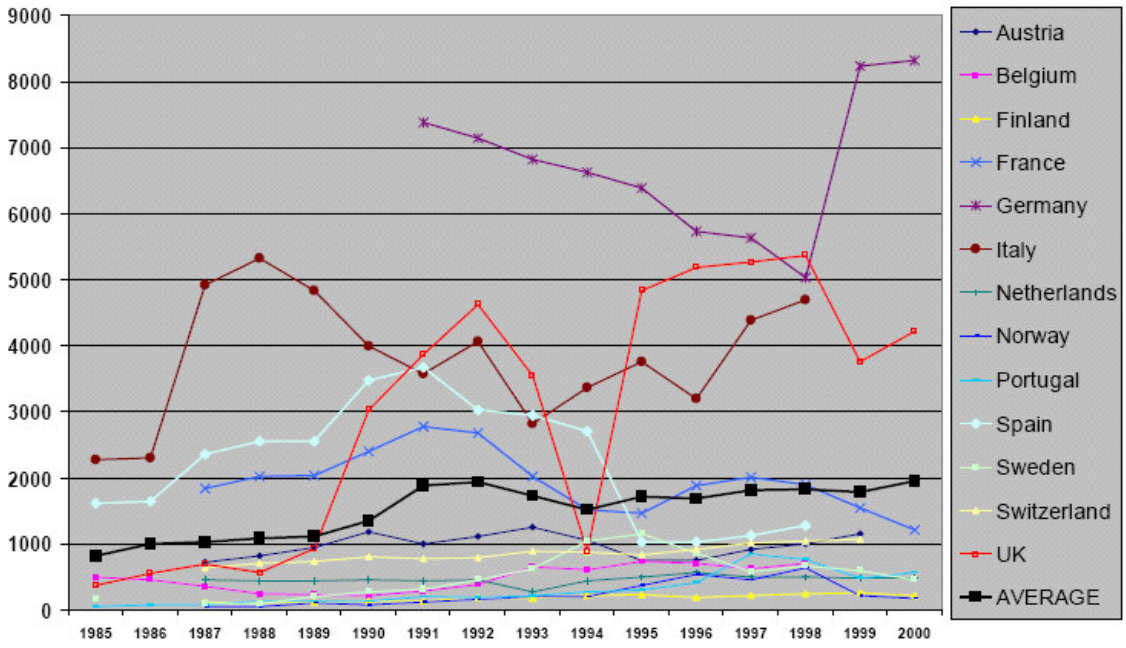
Source: NERA, Study of the financing of and public budget contributions to railways, January 2004.

The total amount of payments for capital investment in rail infrastructure in 2001 for fourteen European countries amounted approximately to € 9.7 billion, which is an average of around 0.7 billion per country. Comparing the table above with table 6.2 shows that for some countries (Austria, Denmark, Finland and Portugal) the yearly needed national contributions for TEN-T projects in the period 2007-2013 are above the investment costs made for railways in 2001.

The next figure presents the development of total capital investment in rail infrastructure in various European countries. Over the years capital investments have shown large fluctuations, especially in the UK. On average the level of investments has more than doubled in the period 1985 – 2000 (from around 0.9 billion international dollars[49] towards 2 billion international dollars).

[49] The international dollar is a hypothetical unit of currency that has the same purchasing power that the U.S. dollar has in the United States at a given point in time, i.e. it means the U.S. dollar converted at purchasing power parity (PPP) exchange rates.

Figure 6.1 Total Capital investment in rail infrastructure 1985-2000 (million 1995 international dollars)



Source: ECMT, The role of government in European railway investment and funding, September 2005.

Conclusion

Based on aforementioned analysis, it is concluded that the national financial sources in the EU+27 countries will not be sufficient to realise all projects in the different policy options in the period 2007-2013. Therefore, additional funding either from EIB loans or from private financial sources (PPPs) is deemed necessary.

When comparing the policy options, it is obvious that in the maximum scenarios other sources of finance are the most needed.

6.4.2 Impact on Public-Private Partnerships

The concept of PPP

PPPs cover a wide range of situations and many different definitions exist in the literature. PPP is a term for the relationship formed between the private sector and the public sector with the aim of introducing private sector resources and/or expertise in order to help provide public services or assets.

A PPP is basically a project deal that transfers the general responsibility for the delivery of a public service to a private company, while the relevant public authority keeps the political responsibility. The deals can include a number of different tasks and services. In light of this assignment, it is assumed that PPP involves that the project is partly financed by the private party.

Next to the primary advantage of value for money, the use of private capital entails the possibility for Member States of off-balance financing of infrastructure investment, provided that risks are adequately transferred to a private sector as defined by the European Accounting Standards, the contingent liability does not account as public debt.

Combining EU funding with PPP

Member State Governments and the European Commission are seeking ways of leveraging EU TEN-T funding by private sector financial and management resources, thereby reducing the pressure on national budgets resulting from the combined co-financing requirements of all EU funded TEN-T projects. There are obvious benefits for both the EU and the Governments of the Member States if mutually acceptable approaches to combination of EU grants and TEN-T budget and PPP models can be identified. This will enable more projects to be implemented faster and hence faster realization of the TEN-T.

There are however a number of fundamental challenges linked to combining EU financing and PPP:

- EU grant based procurement is typically based on input specifications whereas procurement of PPP projects is based on output specifications;
- EU grant based procurement is typically centred on an investment (with the national or local authorities having the responsibility for subsequent operations and maintenance), whereas procurement of PPP projects is typically based on combined procurement of all works and services for the full project life cycle in one tender and one contract;
- The negotiated procurement procedure used in most PPP projects (where the number of bidders is being reduced gradually during negotiations and only 2-3 bidders prepare detailed designs and submit final bids) is difficult to combine with the strong focus on equal treatment under procurement of EU financed projects;
- At the same time there is a fundamental difference in the premises for accessing private capital and EU grant funding:
  - Private capital requires that the project (including possible budget and donor subsidy elements) is financially viable so that the private sector can get an acceptable financial return given the risks of the project. On the other hand private capital is not concerned with the socio-economic benefits of a given projects (unless it has a potential impact on their risk or return);
  - EU grant funding is allocated based on the projects socio-economic benefits. On the other hand for instance grant financing does not put a positive premium on financial viability.

European Union financial instruments

The Commission has responded to the lagging implementation through initiating a range of facilities aimed at enhancing private financing and enhancing the implementation capacity at the Member States:

- The direct sources of funding concern:
  a. Cohesion Fund;
  b. European Regional Development Fund;
  c. TEN-T budget.

- The instruments to facilitate private capital concern:
  d. Risk Capital Facility;

e. Loan Guarantee Scheme.

- The Commission has furthermore initiated several non-financial instruments to support the preparation of the TEN-T projects, most notably:
    f. JASPERS, focussed on technical assistance to the Member States;
    g. Trans-European Network Executive Agency (TEN-TEA); focussed on management of the Commission's TEN-T Budget.

The TEN Financial Regulation[50] provides that the TEN budget can be used for the following purposes:

- Co-financing of studies (up to 50% of the costs of the study including preparatory, feasibility and evaluation studies);
- Direct grants for investment in duly justified cases;
- Risk capital (up to 1% of the budget);
- EIB Guarantee Scheme;
- Interest subsidies on loans granted by the European Investment Bank or other public or private financial bodies.

Of these instruments, only the newly designed guarantees scheme is expected to help attract private capital. In the following part, the different instruments are described and their impact on attracting private finance is addressed.

Loan Guarantee Scheme

The Loan Guarantee Scheme is going to be implemented in 2007 based on market research by the EIB showing that:

- Private parties seeks to mitigate (traffic) risks;
- The European Commission is reluctant to accept traffic risk;
- Financial simulations showed that the traffic risk is reduced by a financial instrument which guarantees payment of debt service in the project preparation period.

The instrument is intended to provide support for specific types of PPPs. The aim is to stimulate private sector investment in priority TEN-T projects by providing credit assistance. It is an EC commitment backing a subordinated debt facility of a TEN project during the ramp-up period, which is from the end of the construction to the stabilization of the cash-flows. The Loan Guarantee Scheme is therefore designed to provide a cushion for unexpected shortfalls in the cash flow available for debt service.

One of the main benefits of the instrument is that it attracts private capital and the money in the guarantee fund can be used flexibly and for more than one project, whereas in case of a grant the money can only be spent once.

A project is eligible for the guarantee if it is within a specific band (BB- to BBB) of project credit ratings. Above a BBB credit rating, the project is investment grade. When the project is investment grade, it can attract private finance on its own merits. In this case, it does not need the guarantee which only makes the project more expensive due to

[50] Regulation (EC) No 2236/95 as amended by Regulation (EC) No 1655/1995 of 19 July 1999, Regulation (EC) No 788/2004 of 21 April 2004 and Regulation (EC) No 807/2004 of 21 April 2004

the risk margin. Projects below a certain credit rating cannot be supported by the guarantee.

The potential leverage effect of this instrument is high .The Commission allocated € 500 million; in addition the EIB provided an additional € 500 million which means that the budget was set at € 1 billion. Under the guarantee facility the provisions for capital allocation, depending on the risk profile of the various projects, can be estimated at a high 20% of the amount guaranteed (i.e. for each 100 million of guarantees provided, a provision of € 20 million should be reserved). This means that under the guarantee facility the total amount of guarantees issued increases to 5 billion euros that is 10 times the initial contribution of the Commission. The guarantee facility underpins the senior debt facility as debt providers have the confidence that subordinated debt will remain in the project. This reduces the risk profile of the project considerably and will attract more senior debt providers. This means that the leverage has the potential to increase considerable further due to this support for bankability. It is feasible to expect that the leverage is 20 to 30 times the original contribution of the Commission. This new instrument can realize a big improvement in the bank ability of the projects with a high leverage effect on attracting new private funds.

It is important to note that the guarantee is not an instrument that finances the investment, but that supports the bankability of a project. In this sense, the Loan Guarantee Fund is currently the only part of the EU TEN budget that can be combined with the Structural and Cohesion Funds.

Other financial instruments that could speed up the development of TEN-T
New instruments in the market for financing of infrastructure have been developed by the World Bank with the purpose of mobilizing private financing for local infrastructure in Europe and Central Asia. The purpose is to develop an alternative public private partnership framework. The proposed new financial instruments are amongst others the setup of a Local Infrastructure Investment Trust to provide primary equity investors with an exit opportunity after completion, a partial risk guarantee facility to cover sub-sovereign breach of contract risks and the possibility of a budget loan to support the cash flow. The feasibility of this approach still has to be tested. It would worthwhile to find out if some of these instruments also can be used for TEN projects.

Conclusion
The potential leverage effect of the Loan Guarantee Scheme is high. It can be combined with the EU Structural Funds and could potentially generate significant private funds to realise TEN-T project. The potential impact is in all policy options the same.

6.4.3 Travel time savings

The impact of each policy option on travel time savings is expressed in two ways:
- Number of hours saved per trip
- Total number of hours saved (multiplied with number of passengers)

The values of these effects are both based on the TEN-STAC study.

The next table lists the number of hours saved per trip compared to the reference scenario for the years 2015 and 2020 as well as the cumulative effect during the period 2010-2025. The total number of hours saved per trip during the period 2010-2025 is, compared to the base case[51], the biggest in the European Added Value-maximum scenario. The number of hours saved per trip in the minimum scenario of the European Added Value policy option is less compared to the maximum scenario because there are fewer projects financed in the minimum scenario and thus less travel time savings. This same effect can be seen in the other policy options (except the Bottleneck option): the number of hours saved per trip in the minimum scenario is always lower compared to the maximum scenario.

The number of hours saved per trip (as well as the total) does not differ between the minimum and maximum scenario of the Bottleneck policy option since no information on additional projects regarding time savings was available. The additional effect of these projects on the number of hours saved is therefore not expressed in the maximum option of the Bottleneck scenario.

Looking at the changes in the number of hours saved per trip/year compared to the base case in the year 2015, it is noted that the effect is zero in the Cross-border-minimum scenario. This due to the fact that in this year all projects in this scenario do not result in effects yet (effects start only in 2016 or later), with the exception of one project (Rheidt-Antwerp) that starts having effects for the first time in the year 2011. This means that when we compare this situation with the base case for this scenario (in which postponement of all investments takes place with a maximum delay of 3 years), no differences will occur for the year 2015. The same is true in the year 2020 for the Bottleneck scenario and the European Added Value-minimum scenario.

[51] In the base case is assumed that cross-border projects will be on average realised 3 years later, bottle-neck projects will on average be realised 2 years later and other type of projects will be realised around 1 year later.

Table 6.4 Changes in the number of hours saved per trip/year in each of the policy options compared to the base case scenario.

Policy options		Cumulative	Changes in the number of hours saved per trip/year compared to the base case scenario	
		2010-2025	2015	2020
Corridor concept	Minimum	-40	-2	-2
	Maximum	-70	-3	-3
Cross-border focus	Minimum	-40	0	-3
	Maximum	-50	-2	-3
Bottleneck focus	Minimum	-40	-4	0
	Maximum [b]	N.A.	N.A.	N.A.
European Added Value focus	Minimum [c]	-50	-2	0
	Maximum[d]	-80	-4	-3

Best minimum Best maximum

a) excl. projects Baudrecourt-Luxemburg since effects are not known

b) not available yet, at least a better score than the minimum scenario

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels – Messina, Frankfurt am Main – Rheidt/Duisburg, Rhine-Meuse and Vienna-Bratislava (waterway) since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Baudrecourt-Stuttgart, Prague-Linz since effects are not known

Based on TEN-STAC study

Multiplying the number of hours saved per trip (compared to the base case) with the number of passengers, results in the total number of hours saved for passengers (compared to the base case). The result can be seen in the next table.

The European Added Value-maximum scenario again results in the greatest number of hours saved for passengers (in the period 2010-2025), followed by the Corridor maximum scenario. The best ranked minimum scenario is the European Added Value policy option which is caused by a relatively high number of forecasted passengers.

Table 6.5 Changes in the total number of hours saved for passengers (in mln hours/year) in each of the policy options compared to the base case scenario

Policy options		Cumulative	Changes in total number of hours saved for passengers compared to the base case scenario (mln hours/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-230	-15	-12
	Maximum	-380	-25	-18
Cross-border focus	Minimum	-200	0	-18
	Maximum[a)]	-220	-1	-18
Bottleneck focus	Minimum	-220	-15	0
	Maximum[b)]	N.A.	N.A.	N.A.
European Added Value focus	Minimum [c)]	-210	-2	0
	Maximum[d)]	-390	-20	-20

Best minimum Best maximum

a) excl. projects Baudrecourt-Luxemburg since effects are not known

b) not available yet, at least a better score than the minimum scenario

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels – Messina, Frankfurt am Main – Rheidt/Duisburg, Rhine-Meuse and Vienna-Bratislava (waterway) since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Baudrecourt-Stuttgart and Prague-Linz since effects are not known

Based on TEN-STAC study

6.4.4 Transport cost savings

The transport cost savings are expressed in the reduction in total freight travel time (in million Euro/year).

The reduction in the total monetized freight travel time is based on the TEN-STAC study. In this study travel time changes are weighted by country-specific values per vehicle hour for road transport and values per ton hour for other modes of transport.

The monetized value of freight travel time saved during the period 2010-2025 is the highest in the Corridor-maximum scenario. The rail/road connection Rodby (Denmark)-Puttgarden (Germany) has a great contribution in this total number of freight travel time saved (nearly € 400 million out of the total of € 1,200 millions of savings during the period 2010-2025).

Table 6.6 Changes in the total monetary value of the reduction of freight travel time (in mln Euro/year) in each of the policy options compared to the base case scenario

Policy options		Cumulative	Change in monetary value of the reduction in freight travel time compared to the base case scenario (mln Euro/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-530	-29	-46
	Maximum	-1,200	-55	-47
Cross-border focus	Minimum	-780	0	-47
	Maximum[a)]	-810	0	-47
Bottleneck focus	Minimum	-480	-25	0
	Maximum[b)]	N.A.	N.A.	N.A.
European Added Value focus	Minimum [c)]	-480	-16	0
	Maximum [d)]	-890	-40	-50

Best minimum Best maximum

a) excl. projects Baudrecourt-Luxemburg since effects are not known

b) not available yet, at least a better score than the minimum scenario

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels – Messina, Frankfurt am Main – Rheidt/Duisburg, Rhine-Meuse and Vienna-Bratislava (both waterways) since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz, Frankfurt am Main-Rheidt/Duisburg, Rhine-Meuse and Vienna-Bratislava (both waterways) since effects are not known

Based on TEN-STAC study

6.4.5 Congestion level

Traffic congestion emerges when transport infrastructure capacity approaches saturation. Congestion brings about a rising in travel times and a rise in the unreliability in travel times.

The impact on congestion levels are assessed by using the reduction of time losses for both passenger and freight transport caused by road congestion (in hours). To monetarise the time losses due to road congestion the TEN-STAC study has used country specific values of time for road passenger transport and road freight transport.

Table 6.7 Changes in the time costs caused by road congestion (mln Euro/year) in each of the policy options compared to the base case scenario

Policy options		Cumulative	Changes in time costs caused by road congestion compared to the base case scenario (mln Euro/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-480	-18	-18
	Maximum	-740	-80	-20
Cross-border focus	Minimum	-190	0	-20
	Maximum [a)]	-240	-1	-20
Bottleneck focus	Minimum	-470	-70	0
	Maximum [b)]	-480	-75	0
European Added Value focus	Minimum [c)]	-230	-10	-1
	Maximum [d)]	-550	-30	-20

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known

b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Frankfurt am Main – Rheidt/Duisburg and Prague-Linz since effects are not known

Based on TEN-STAC study

The time costs caused by road congestion are decreased with around 740 million Euro in the Corridor-maximum scenario (compared to the base case) during the period 2010-2025. Of all the policy options this is the highest decrease in road congestion costs. The lowest decrease in road congestion costs arises in the Cross-border policy option.

A study by Infras/IWW[52] estimated total road congestion costs in 1995 at € 33 billion. Currently 7,500 kilometres of road in the EU or 10% of Europe's roads are affected by traffic jams. This congestion costs Europe € 50 billion per year, in other words 0.5% of the EU's GDP. By 2010 it could rise to 1%. The corridor maximum scenario would reduce time costs caused by road congestion with on average € 0.6 billion in the period 2010-2025. This is approximately € 40 million per year, which is 0.08% of the current road congestion costs in Europe.

6.4.6 Modal shift

The impact on modal shift is assessed by using the following indicators from the TEN-STAC report:

- Road freight traffic shifted to rail, IWW or sea transport (mln tonkm)
- Road and air passenger traffic shifted to rail (mln passkm)

[52] External costs of transport: Accident, Environmental and Congestion Costs in Western Europe; Infras/IWW, update 2004

It is expected that the greatest shift of freight from road to rail, IWW and sea transport during the period 2010-2025 will occur in the European Value Added-maximum scenario (approximately 90 billion ton-kilometres), followed by the Corridor maximum scenario.

Total freight transport by road, rail and inland waterways in the EU+27 measured around 2,400 billion ton-kilometres in 2005, of which 71% was transported by truck. Total freight transport by the three inland modes in the EU+27 is believed to arrive at 2,685 billion ton-kilometres in 2010 and 3,440 billion ton-kilometres in 2025. Road share is expected to rise to 73% in 2010 and 77% in 2025. The total transport performance by road in the EU+27 is expected to grow with approximately 680 billion ton-kilometres in the period 2010-2025[53].

Table 6.8 Road freight traffic shifted to rail, IWW or sea transport in each of the policy options compared to the base case scenario (mln tonkm/yr)

Policy options		Cumulative	Road freight traffic shifted to rail, IWW or sea transport compared to the base case scenario (mln tonkm/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	65,230	4,670	1,880
	Maximum	87,190	6,070	4,120
Cross-border focus	Minimum	49,560	0	4,120
	Maximum[a)]	54,030	10,220	4,360
Bottleneck focus	Minimum	41,230	3,110	0
	Maximum[b)]	42,370	3,680	0
European Added Value focus	Minimum [c)]	44,050	2,640	250
	Maximum[d)]	90,660	7,300	4,370

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known
b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known
c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known
d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

The greatest shift of passengers from road and air to rail during the period 2010-2025 occurs in the European Value Added-maximum scenario (approximately 17 billion passenger-kilometres), closely followed by the Corridor-maximum scenario.

[53] European energy and transport: Trends to 2030 – update 2005, European Commission, May 2006

Table 6.9 Road and air passenger traffic shifted to rail in each of the policy options compared to the base case scenario (mln passengerkm/yr)

Policy options		Cumulative	Road and air passenger traffic shifted to rail compared to the base case scenario (mln passenger km/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	13,140	580	705
	Maximum	14,040	1,100	890
Cross-border focus	Minimum	4,370	0	890
	Maximum[a)]	5,170	-53	880
Bottleneck focus	Minimum	5,220	880	0
	Maximum[b)]	N.A.	N.A.	N.A.
European Added Value	Minimum [c)]	6,750	110	0
focus	Maximum[d)]	16,780	690	890

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known

b) not available yet, at least a better score than the minimum scenario

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

The total passenger transport by road, air and rail in the EU+27 measured around 6,000 billion passenger-kilometres in 2005, of which private road cars had a share of 78%, air transport 6.2%, public transport by road 8.5% and rail transport 7.2%. Total passenger transport by these modes in the EU+27 is believed to arrive at approximately 6,500 billion passenger-kilometres in 2010 and 8,000 billion passenger-kilometres in 2025. The share of private cars (and motorcycles) is expected to stabilise around 78%, whereas aviation is believed to arrive at a share of 8.7% in 2025. The total passenger transport performance by road (private cars, motorcycles and public road transport) and air in the EU+27 is expected to grow with approximately 1,400 billion passenger-kilometres in the period 2010-2025[54].

6.4.7 Accessibility

Conventional accessibility indicators measure the total effect of both geographical location (periphery v. core) and quality of transport provided by the transport system and so always show a steep gradation in accessibility from the core to the periphery. However, public policy cannot change the fact that some regions are central and some are peripheral, i.e. provide the same level of accessibility to all regions. Public policy can only alleviate disadvantages through unequal transport provision.

[54] European energy and transport: Trends to 2030 – update 2005, European Commission, May 2006

Therefore, in the framework of this study, two modal accessibility indicators were defined which distinguish between geographical location and quality of transport. These indicators assume that people in the peripheral regions cannot expect to enjoy the same level of accessibility (measured in traditional terms) as the central regions, but that they can demand to be able to reach relevant destinations with the same travel speed ("as the crow flies") as the people in the central regions.

Tables 6.10 and 6.11 show the two defined accessibility indicators, average speed of interregional road and rail trips, in the Reference Scenario and the eight policy scenarios in 2015 and 2020 as calculated with the network database of the SASI model (see Annex 2). For comparison, also the average speeds in 2006 are shown. The shaded cells indicate the best-performing minimum and maximum scenarios.

It can be seen that road and rail speeds increase over time also in the Reference Scenario. This is not only due to the implementation of the other TEN-T priority projects not selected for earlier construction in the policy scenarios but also due to assumptions about gradual reductions in waiting times at inner-European borders due to further European integration.

Table 6.10 Average speed of interregional road trips (kph), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	Average speed of interregional road trips (kph)						
		2006	2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	41.68	42.88	*+0.04*	*+0.20*	43.23	*+0.01*	*+0.05*
	Cross-border			*+0.16*	*+0.16*		*+0.04*	*+0.04*
	Bottleneck			*+0.07*	*+0.07*		*+0.02*	*+0.02*
	European AV			*+0.04*	*+0.04*		*+0.01*	*+0.01*
EU+15	Corridor	44.65	45.21	*+0.06*	*+0.25*	45.43	*+0.01*	*+0.06*
	Cross-border			*+0.20*	*+0.20*		*+0.05*	*+0.05*
	Bottleneck			*+0.09*	*+0.09*		*+0.02*	*+0.02*
	European AV			*+0.06*	*+0.06*		*+0.01*	*+0.01*
EU+12	Corridor	34.24	36.50	*+0.01*	*+0.05*	36.99	*0.00*	*+0.01*
	Cross-border			*+0.05*	*+0.05*		*+0.01*	*+0.01*
	Bottleneck			*+0.01*	*+0.01*		*0.00*	*0.00*
	European AV			*+0.01*	*+0.01*		*0.00*	*0.00*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

Table 6.11 Average speed of interregional rail trips (kph), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	2006	Average speed of interregional rail trips (kph)					
			2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	29.68	31.43	*+0.53*	*+0.90*	32.72	*+0.47*	*+0.65*
	Cross-border			*+0.50*	*+0.70*		*+0.53*	*+0.57*
	Bottleneck			*+0.82*	*+0.82*		*+0.21*	*+0.21*
	European AV			*+1.00*	*+1.17*		*+0.83*	*+1.35*
EU+15	Corridor	32.52	34.65	*+0.69*	*+1.18*	36.04	*+0.65*	*+0.90*
	Cross-border			*+0.67*	*+0.95*		*+0.75*	*+0.80*
	Bottleneck			*+1.15*	*+1.15*		*+0.29*	*+0.29*
	European AV			*+1.33*	*+1.57*		*+1.12*	*+1.86*
EU+12	Corridor	23.10	23.89	*+0.16*	*+0.25*	24.81	*+0.04*	*+0.06*
	Cross-border			*+0.09*	*+0.10*		*+0.03*	*+0.03*
	Bottleneck			*+0.06*	*+0.06*		*+0.01*	*+0.01*
	European AV			*+0.21*	*+0.25*		*+0.14*	*+0.16*

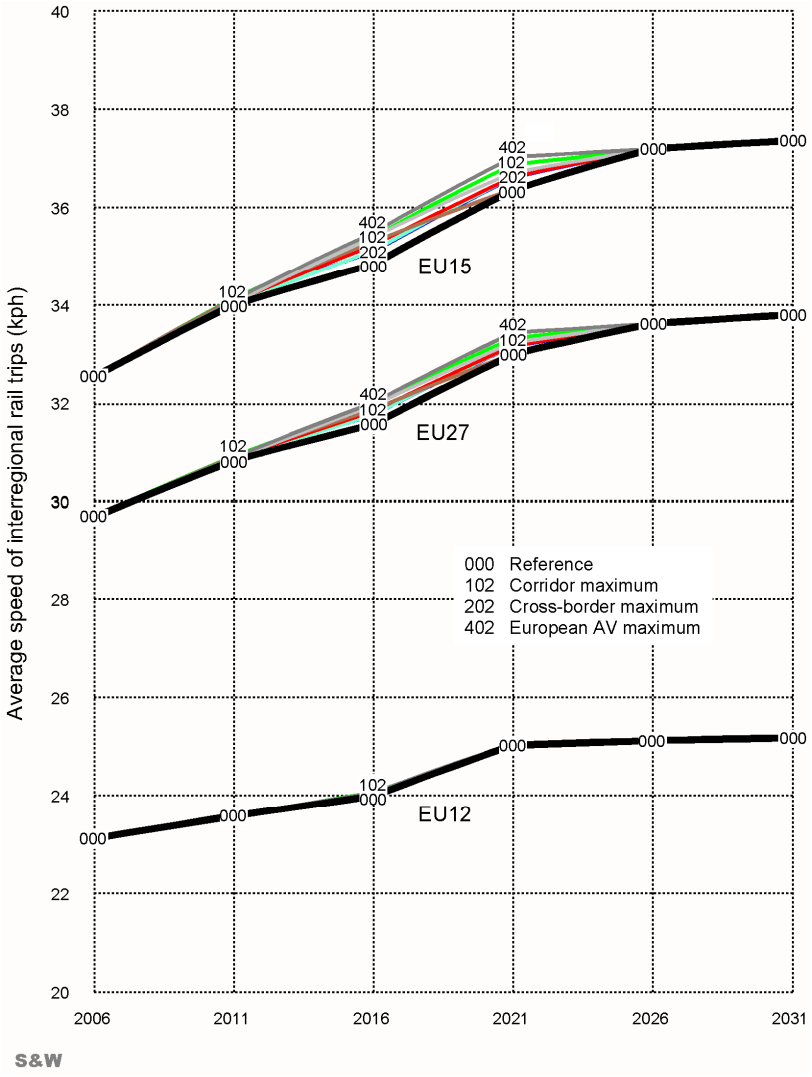
Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

A comparison between the two tables shows that the impacts of the policy scenarios are much greater for rail than for road, an obvious consequence of the dominance of rail over road projects in the policy scenarios. Also not surprising is that in all cases the maximum scenarios having larger effects than the corresponding minimum scenarios, as these contain more earlier implemented projects. If all EU member states are considered together (EU+27), the Corridor maximum and the European Added Value maximum scenario have the greatest impact on average rail speeds, if only the minimum scenarios are compared, the European Added Value minimum scenario is the winner.

If the old EU member states (EU+15) and the new member states (EU+12) are compared, it is confirmed that almost all selected projects are in the old member states: Average road and rail speeds in the new member states are not only significantly lower than in the old member states, they also increase only marginally through the TEN-T projects selected in the policy scenarios. Figure 6.2 highlights this imbalance over time.

The diagram also shows that the speed increases through the earlier implementation of projects in the policy options are only temporary and gradually disappear until 2026, as by that time the same projects will be implemented in the Reference Scenario.

Figure 6.2 Average speed of interregional rail trips, EU+27, EU+15 and EU+12, 2006-2031



6.4.8 Competitiveness

Economic competitiveness is measured by gross domestic product (GDP) per capita. Table 6.12 shows GDP per capita in the eight scenarios as forecast by the SASI model. The first aspect to note is that relative large improvements in accessibility (see Tables 6.10 and 6.11) translate into relatively small gains in economic performance. Not surprisingly, the Corridor maximum scenario, which further improves the accessibility of the largest metropolitan areas in Europe, performs best if economic growth is the major objective. However, if only the minimum scenarios can be implemented, the Cross-border minimum scenario is more successful in generating GDP growth.

Table 6.12 GDP per capita (€ of 2006), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	2006	GDP per capita (€ of 2006) 2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	23,307	28,373	*+0.024*	*+0.059*	31,494	*+0,045*	*+0,092*
	Cross-border			*+0.036*	*+0.043*		*+0.067*	*+0.074*
	Bottleneck			*+0.028*	*+0.028*		*+0.032*	*+0.032*
	European AV			*+0.027*	*+0.036*		*+0.049*	*+0.076*
EU+15	Corridor	28,359	34,091	*+0.025*	*+0.061*	37,537	*+0.046*	*+0.095*
	Cross-border			*+0.037*	*+0.044*		*+0.069*	*+0.077*
	Bottleneck			*+0.029*	*+0.029*		*+0.033*	*+0.033*
	European AV			*+0.027*	*+0.037*		*+0.050*	*+0.078*
EU+12	Corridor	4,618	6,242	*+0.016*	*+0.029*	7,486	*+0.022*	*+0.043*
	Cross-border			*+0.015*	*+0.015*		*+0.026*	*+0.027*
	Bottleneck			*+0.007*	*+0.007*		*+0.005*	*+0.005*
	European AV			*+0.013*	*+0.018*		*+0.024*	*+0.031*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

A problem with the GDP per capita values for 2015 and 2020 is that these are snapshots of only two years. However, as it has been shown for average speed of rail trips (see Figure 6.2), the four policy options represent only different alternatives of speeding up the implementation of the TEN-T programme, which is assumed to be implemented even without MAP TEN-T funding, only later, in the Reference Scenario, with the effect that after 2026 the networks of all scenarios are identical.

This suggests looking not only at the GDP effects at a particular year but at the cumulative effects over all years. Table 6.13 shows the cumulative GDP effects until 2030 as forecast by the SASI model. GDP effects are here defined as the sum of the differences between total GDP per year of all member states in EU+27, EU+15 and EU+12, respectively, in the policy scenario and the Reference Scenario in Euro of 2006 (these effects are indirect effects only, i.e. do not include the economic effects of the construction of the infrastructure). Table 6.14 shows the same results discounted with 5% per year, and Tables 6.15 and 6.16 show the same results divided by population, i.e. GDP per capita.

Table 6.13 Cumulative GDP effects (mln € of 2006), EU+27, EU+15 and EU+12, 2009-2030

Area	Scenario v. Reference Scenario (mln € of 2006)							
	Corridor		Cross-border		Bottleneck		European AV	
	Min	Max	Min	Max	Min	Max	Min	Max
EU+27	72,285.2	142,913.4	98,348.0	110,598.1	54,218.2	54,268.6	73,145.6	124,813.0
EU+15	70,623.0	139,896.5	96,578.9	108,803.5	53,736.2	53,786.5	71,451.2	122,435.9
EU+12	1,662.3	3,016.8	1,769.1	1,794.6	482.1	482.1	1,694.4	2,377.2

Best minimum Best maximum

Table 6.14 Cumulative GDP effects in Net Present Value (mln € of 2006 discounted by 5% per year), EU+27, EU+15 and EU+12, 2009-2030

Area	Scenario v. Reference Scenario (mln € of 2006 discounted by 5% per year)							
	Corridor		Cross-border		Bottleneck		European AV	
	Min	Max	Min	Max	Min	Max	Min	Max
EU+27	36,742.4	75,232.7	50,404.3	57,233.2	30,017.3	30,050.4	37,346.5	61,807.7
EU+15	35,864.5	73,639.8	49,494.0	56,308.2	29,730.3	29,763.4	36,488.8	60,596.4
EU+12	878.0	1,592.8	910.2	924.9	287.0	287.0	857.7	1,211.3

Best minimum Best maximum

Table 6.15 Cumulative GDP per capita effects (€ of 2006), EU+27, EU+15 and EU+12, 2009-2030

Area	Scenario v. Reference Scenario (€ of 2006)							
	Corridor		Cross-border		Bottleneck		European AV	
	Min	Max	Min	Max	Min	Max	Min	Max
EU+27	153.7	304.2	209.6	235.6	115.2	115.3	155.5	265.3
EU+15	188.3	373.5	258.1	290.7	143.1	143.3	190.5	326.4
EU+12	17.5	31.8	18.7	19.0	5.2	5.2	17.8	25.0

Best minimum Best maximum

Table 6.16 Cumulative GDP per capita effects in Net Present Value (€ of 2006 discounted by 5% per year), EU+27, EU+15 and EU+12, 2009-2030

Area	Scenario v. Reference Scenario (€ of 2006 discounted by 5% per year)							
	Corridor		Cross-border		Bottleneck		European AV	
	Min	Max	Min	Max	Min	Max	Min	Max
EU+27	78.1	160.2	107.4	122.0	63.8	63.9	79.4	131.4
EU+15	95.6	196.6	132.3	150.5	79.2	79.3	97.3	161.5
EU+12	9.2	16.8	9.6	9.8	3.1	3.1	9.0	12.8

Best minimum Best maximum

It can be seen that the cumulative effects are substantial compared with the investments (see section 4.2 and 5.4.1), and that they are consistent with the snapshot results of Table 6.12. If the maximum scenarios can be financed, the Corridor maximum scenario generates the strongest economic effects, whereas if only the minimum scenarios are affordable, the Cross-border minimum scenario is the best option.

6.4.9 Territorial cohesion

The impact of the policy scenarios on the cohesion between the regions in the European Union can be measured by the Gini coefficient. The Gini coefficient is a measure of the deviation of a distribution of values from a completely equal distribution. In the following tables the Gini coefficient is scaled between 0 and 100, where 0 indicates equal distribution and 100 extreme polarisation; the higher the coefficient, the greater the disparities between the regions. Negative values in the change of the Gini coefficient therefore indicate pro-cohesion effects, whereas positive values indicate polarisation.

Tables 6.17 and 6.18 show the Gini coefficient of regional accessibility and GDP per capita in the eight scenarios in 2015 and 2020 as calculated in the SASI model.

Table 6.17 Gini coefficient of accessibility (0-100), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	Gini coefficient of accessibility (0-100)						
		2006	2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	22.13	21.40	*-0.13*	*-0.48*	21.03	*-0.17*	*-0.22*
	Cross-border			*-0.22*	*-0.31*		*-0.12*	*-0.15*
	Bottleneck			*-0.36*	*-0.36*		*-0.12*	*-0.12*
	European AV			*-0.16*	*-0.21*		*-0.25*	*-0.41*
EU+15	Corridor	22.90	22.61	*-0.23*	*-0.67*	22.32	*-0.25*	*-0.33*
	Cross-border			*-0.31*	*-0.43*		*-0.20*	*-0.23*
	Bottleneck			*-0.45*	*-0.45*		*-0.15*	*-0.15*
	European AV			*-0.26*	*-0.34*		*-0.32*	*-0.55*
EU+12	Corridor	16.09	14.28	*+0.38*	*+0.52*	13.75	*+0.11*	*+0.17*
	Cross-border			*+0.21*	*+0.22*		*+0.09*	*+0.09*
	Bottleneck			*0.00*	*0.00*		*0.00*	*0.00*
	European AV			*+0.42*	*+0.47*		*+0.29*	*+0.34*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

Table 6.18 Gini coefficient of GDP per capita (0-100), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	2006	Gini coefficient of GDP per capita (0-100)					
			2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	34.93	34.05	*-0.00*	*+0.01*	33.44	*-0.01*	*+0.02*
	Cross-border			*+0.02*	*+0.02*		*+0.03*	*+0.03*
	Bottleneck			*-0.01*	*-0.01*		*-0.01*	*-0.01*
	European AV			*-0.01*	*-0.01*		*-0.02*	*-0.03*
EU+15	Corridor	23.22	23.26	*-0.01*	*+0.02*	23.27	*-0.02*	*+0.03*
	Cross-border			*+0.04*	*+0.03*		*+0.05*	*+0.04*
	Bottleneck			*-0.03*	*-0.03*		*-0.03*	*-0.03*
	European AV			*-0.02*	*-0.02*		*-0.05*	*-0.07*
EU+12	Corridor	36.22	35.84	*+0.01*	*+0.01*	35.75	*+0.01*	*+0.02*
	Cross-border			*+0.01*	*+0.01*		*+0.01*	*+0.01*
	Bottleneck			*0.00*	*0.00*		*0.00*	*0.00*
	European AV			*+0.01*	*+0.01*		*+0.01*	*+0.01*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

Table 6.17 shows that there is a slight trend of equalisation in accessibility in the Reference Scenario in both the old and the new Member States (accessibility here means a range of multimodal accessibility indicators, including air, as used in the SASI model) and that all policy scenarios reinforce the trend towards more cohesion in the old member states. The effect in the new Member States works in the opposite direction towards more polarisation because mainly the capital regions of these countries benefit from the network improvements in the core regions. The comparison of the scenarios gives a more complex picture. The economically most successful scenarios (see Tables 6.12 to 6.16) are not necessarily also the best for cohesion: the Corridor maximum scenario, which did most for competitiveness, improves the cohesion in accessibility between the regions in the old member states but increases the disparities in accessibility between the regions in the new member states. It can also be seen that already in 2020 the cohesion effects have changed: now the European Added Value maximum scenario has the greatest cohesion effects, though again only in the old member states.

Table 6.18 confirms the lesson that relative large changes in accessibility have only small effects on the distribution of economic activity. However, the direction of impacts has changed: now even the Corridor and Cross-border scenarios contribute to (marginal) polarisation. Only the European Added Value maximum scenario contributes significantly to territorial cohesion.

6.4.10 Impact on interoperability and interconnection of national networks

Interconnection covers the physical linking of national transport networks. Interconnection of transport networks does not however guarantee interoperability of services provided over those networks. In the rail transport lack of interoperability is

reflected e.g. in different type of track gauges, different type of electrical power supply, differences in signalling and speed control, train safety technologies as well as different job profiles for drivers. Interoperability of national (rail) transport networks therefore requires the use of common standards and protocols.

To determine the impact of the different TEN-T policy options on interoperability and interconnection of national networks, the projects (within the policy options) will be assessed by looking into:

- Interconnectivity: are the projects domestic or international (and thus linking national transport networks);
- Interoperability: are the (international) projects using common standards/protocols.

Interconnectivity

In the next table the projects within the different policy options are classified as whether they are domestic (not linking national networks) or international (linking national networks).

It is obvious that in the cross-border policy options all projects are aimed at improving interconnectivity since they are all international projects. The Bottleneck policy option is not aiming at improving interconnectivity since 80% of the projects are domestic. The Corridor and European Added Value policy option can be classified as 'mixed' options: around half of the projects are domestic and half are international.

Table 6.19 Number of projects classified as being domestic (within one country, not linking national networks) or international (linking national networks)

Policy options		Total number of projects	Of which domestic	Of which international
Corridor concept	Minimum	11	45%	55%
	Maximum	22	45%	55%
Cross-border focus	Minimum	9	0%	100%
	Maximum [a)]	16	0%	100%
Bottleneck focus	Minimum	20	80%	20%
	Maximum[b)]	24	83%	17%
European Added Value focus	Minimum [c)]	18	44%	66%
	Maximum [d)]	26	50%	50%

Best minimum Best maximum

Interoperability

Since almost all of the projects within the different policy options concern rail projects we will focus on the question whether these rail projects improve the interoperability of the rail networks[55].

[55] Besides, lorries and coaches on our roads and inland ships on inland waterways are able to cross national borders within the European Union without stopping. The question of interoperability of roads and inland waterways is therefore less important compared to rail.

Today there are more than twenty signalling and speed control systems operating at the same time in Europe. The Thalys, linking Paris and Brussels in particular, has to be equipped with seven different signalling and speed control systems, entailing extra cost and increased breakdown risks. The expansion of future rail infrastructure is therefore closely linked with the improvement in interoperability[56].

Today great hopes are pinned on the innovative European Rail Traffic Management System (ERTMS). Through ERTMS, digital technology will be introduced for European rail infrastructure. This standard train protection system will greatly simplify and speed up the technical interoperability of cross-border transport (the different signalling systems for various networks are no longer required in the cab of the train), raise safety standards to a high common level throughout the EU and to increase the capacity utilization of the existing rail network. This means in effect that a new rail project which does not include ERTMS will represent a barrier to interoperability for the whole of the operational life – 30 years, perhaps more – of the signalling equipment[57].

However implementing ERTMS will be costly since the ERTMS consists of two modules: a GSM-R radio system to exchange information between the ground and the locomotive, and the European Train Control System (ETCS). In addition some of the old functioning systems are still a long way from the end of their useful lifetime. As lines and the locomotive both have to be equipped with the ETCS, trains will in the interim period have to provide service on the established system and in parallel have to adopt the ETCS. In the short term however, this will not result in competitive advantages vis-à-vis competitors who do not deploy the ETCS yet.

Most of the benefits of the ERMTS system will not be felt until there is an integrated set of lines and trains equipped with this system. A 'critical mass' will therefore have to be reached. To boost the deployment, the European Commission has made mandatory the installation of ERTMS on new sections or lines, in 2002 for the High Speed network and in 2006 for the priority projects of the conventional network. Moreover, financing of railway infrastructures by TEN-T funds is now bound to the compulsory installation of ERTMS[58].

However, the lines equipped today do not yet constitute a network. That is why in March 2005 a Memorandum of Understanding (MoU) was agreed between the EU and national rail operating companies to set priorities: six rail freight corridors should be fitted with ERTMS: Rotterdam-Genoa, Naples-Berlin-Stockholm, Antwerp-Basle/Lyons, Seville-Lyons-Turin-Trieste-Ljubljana, Dresden-Prague-Brno-Vienna-Budapest and Duisburg-Berlin-Warsaw (see figure below).

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56 Jacques Barrot,"Developing the rail market in Europe", Opening session of the Congress «Eurailspeed» Milano, 7 November 2005.

57 Source: http://ec.europa.eu/transport/rail/interoperability/doc/ertms-en.pdf

58 'Report from the commission to the council, the European parliament, the European economic and social committee and the committee of the regions', accompanying document, Commission Staff working Document, Brussels, 13-3-2007, SEC(2007)313.

Figure 6.3 The six corridors on which the EU and national railways have agreed to deploy ERTMS

Source: CER, 'Annual Report 2005/2006', Brussels.

Since financing of railway infrastructures by TEN-T funds is now bound to the compulsory installation of ERTMS, the different policy scenario's are 'judged' to their interoperability based on:

- The total number of rail projects in the TEN-T policy options;
- The total number of rail projects that contribute to the realisation of the six ERTMS corridors.

The results can be found in the next table. The total number of rail projects as well as the total number of rail projects that contribute to the realization of the six ERTMS corridors is the greatest in the Corridor-maximum and European Value Added-maximum policy option.

Table 6.20 Characteristics of TEN-T policy options

Policy options		Total number of projects	Of which rail projects	Of which part of the six rail freight corridors
Corridor concept	Minimum	11	11	4
	Maximum	22	22	11
Cross-border focus	Minimum	9	9	5
	Maximum [a)]	16	14	6
Bottleneck focus	Minimum	20	18	4
	Maximum [b)]	24	19	4
European Added Value focus	Minimum [c)]	18	16	3
	Maximum [d)]	26	24	6

Best minimum Best maximum

6.5 Environmental impacts

6.5.1 Emissions

In this study we will limit the assessment of the impacts on emissions to the changes in emissions of NOx and particulates (PM). Both indicators are based on the TEN-STAC study. The impact on the emissions is quantified as the difference between the relevant policy option and the base scenario in which the starting year of operations for all projects in the policy option is delayed with 3 years for cross-border sections and 2 years for bottleneck sections. The change in emissions results for the greatest part from a shift of kilometres travelled from road to rail.

The next two tables give an overview of the impact on emissions compared with the base case scenario for the years 2015 and 2020 as well as the cumulative effect during the period 2010-2025.

The greatest cumulative reduction of NOx (11,000 tonnes) during the period 2010-2025 is achieved under the Corridor-maximum scenario. For the individual years also reductions in NOx emissions can be seen, except for the year 2020 in the European Added Value-minimum scenario. In this year only the effect of the project Rhine-Meuse differ compared to the base case scenario. Due to the Rhine-Meuse project freight is shifted from road to inland waterways. The technological progress in case of freight road transport is however far more advanced than in case of inland waterways, where the ships' engines have a high rate of emissions. This can be explained by the long life span of ships, leading to a slower impact of technological improvements, compared to road transport.

Table 6.21 Changes in NOx emissions in each of the policy options compared to the base case scenario (in 1.000 kg/yr)

Policy options		Cumulative	Change in NOx compared to the base case scenario (* 1.000 kg/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-5,540	-220	-400
	Maximum	-11,670	-670	-550
Cross-border focus	Minimum	-6,560	0	-550
	Maximum[a)]	-7,270	-30	-530
Bottleneck focus	Minimum	-5,550	-520	0
	Maximum [b)]	-5,400	-440	0
European Added Value focus	Minimum [c)]	-2,710	-130	10
	Maximum [d)]	-7,830	-340	-530

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known

b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

The effects on the emissions of Particulates differ substantially between the policy options. In the Corridor and Cross-border option we see a decrease in the period 2010-2025, in the Bottleneck and European Added Value option an increase in the emissions of Particulates takes place. In the Corridor and Cross-border minimum option only two projects in each policy option are responsible for the decrease in the emissions of Particulates: the Lyon-Torino rail project and the Milan-Padova rail project (Corridor minimum option) and the Lyon-Torino and the Venezia-Ronchi-Sud-Triest-Divaca rail project (Cross-border minimum option). All the other projects in both minimum scenarios only result in increasing Particulates emissions. The remaining minimum policy options, Bottleneck and European Added Value, do not incorporate one of these three previously mentioned projects resulting in increasing emissions of particulates in these policy options. There are some projects that result in decreasing Particulates emissions but their effects are too small to compensate the increase of Particulates emissions in the other projects. The inclusion of the Lyon-Torino and Milan-Padova projects in the European Added Value-maximum scenario results in a lower emissions level in the maximum scenario compared to the minimum scenario.

The reason that in a lot of projects the effects on the emissions of Particulates show an increase is partly due to the fact that in some projects high emissions arise from the use of diesel locomotives. Another reason is the shift from road to inland shipping where the ships' engines have a high rate of emissions.

Table 6.22 Changes in emissions of Particulates in each of the policy option compared to the base case scenario (in 1.000 kg/yr)

Policy options		Cumulative	Change in PM compared to the base case scenario (*1.000 kg/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-90	+5	-37
	Maximum	-140	+5	-29
Cross-border focus	Minimum	-170	0	-29
	Maximum [a]	-130	-5	-25
Bottleneck focus	Minimum	+80	+2	0
	Maximum [b]	+120	+21	0
European Added Value focus	Minimum [c]	+160	-2	+4
	Maximum [d]	+40	+3	-30

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known

b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

Based on above table, it is concluded that the Cross-border minimum and Corridor maximum scenario represent the best scores on emissions.

6.5.2 Climate

The next table gives an overview of the impact of each of the policy options, compared to the relevant base case scenario, on CO_2 emissions for the years 2015 and 2025 as well as the cumulative effect during the period 2010-2025. Again the change in CO_2 emissions is based on the TEN-STAC report. The change in CO_2 emissions results from a shift of kilometres from road and air to rail from both passenger and freight transport.

For the same reasons as mentioned in the previous paragraphs no change in the emission of CO_2 takes place in some years of the scenarios: in these years the number of finished projects is the same in both the policy option and the base case scenario.

All of the policy options result in lower CO_2 emissions in the period 2010-2025 compared to the base case situation. The greatest CO_2 reductions arise in the European Added Value-maximum scenario where emissions decrease with 7.8 million tonnes.

The decrease in emissions is the lowest in the Bottleneck scenario. This is due to the fact that some of the projects in the Bottleneck scenario lead to an increase of CO_2 emissions, for example the upgrading of the road between Patras and Korinthos leads to a shift from rail to road resulting in increasing CO_2 emissions. In the other policy options almost all of the projects result in decreasing CO_2 emissions due to a shift from road to rail.

Table 6.23 Changes in emissions of CO_2 in each of the policy options compared to the base case scenario (in 1.000 kg/yr)

Policy options		Cumulative	Change in CO_2 compared to the base case scenario (* 1.000 kg/yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-5,672,170	-412,120	-178,680
	Maximum	-7,555,520	-563,360	-359,640
Cross-border focus	Minimum	-4,153,560	0	-359,640
	Maximum[a)]	-4,576,760	-12,580	-380,700
Bottleneck focus	Minimum	-2,574,040	-297,550	0
	Maximum[b)]	-2,732,640	-376,850	0
European Added Value focus	Minimum [c)]	-3,683,770	-219,350	-21,050
	Maximum[d)]	-7,840,740	-631,470	-380,700

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known

b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known

c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known

d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

Total CO_2 emissions by the transport sector in the EU+27 measured around 1,062 million tonnes in 2005. Total CO_2 emissions by the transport sector are believed to arrive at approximately 1,104 million tonnes in 2010 and 1,157 million tonnes in 2025. The European Added Value concept is believed to produce the largest decrease of CO_2 which corresponds to 15% of the total expected growth of CO_2 emissions by the transport sector in the same period.

6.6 Social impacts

6.6.1 Employment

The impact on employment comprises the creation of permanent and temporary jobs. The temporary effects cover the jobs related to constructing the infrastructure. These temporary effects are however of minor importance compared to the permanent creation of jobs since after completion of the infrastructure project these jobs will disappear. To evaluate an infrastructure project the creation of temporary jobs is therefore not a recommended criterion.

Permanent jobs arise from operating the infrastructure project. These jobs can be seen as a direct effect of the infrastructure project. However if the regional work force is not subject to skills-upgrading the longer-term effects will be very limited.

Permanent indirect impacts on employment are related to the improved accessibility of a given region by reduced travel time costs/time and transport/energy costs, thereby possibly attracting new enterprises and related socio-economic activities resulting in the creation of new jobs.

In order to assess the employment impacts of the policy options, more detailed research on the individual projects is required, which is outside the scope of this study.

6.6.2 Innovation

Innovation is the use of new ideas, processes, goods, services and practices in a more or less commercial way, based on any (new) application of science and/or technology. Innovation in technology can improve the sustainability of transport without restricting economic growth. Innovation can reduce the adverse environmental impact of transport operations by reducing emissions, noise levels, etc., and can improve their quality in terms of speed, comfort, etc., as well as their safety. Similarly, by increasing the competitiveness of certain modes of transport, it can present them with new opportunities and can strengthen their position in relation to the other modes, one example being the TGV high-speed trains.

Much of the technological innovation is undertaken by the private sector. The main role of the EU is to regulate and stimulate innovation. Regulation consists in establishing interoperability and in promoting the introduction of useful technology which, although it is already fully developed, requires the imposition of more stringent rules to make it economically justifiable.

Stimulation proceeds from the identification of market developments which demand active EU involvement and of technological solutions for which the market is unlikely to initiate the innovation process and the aim of stimulatory action by the EU is to develop key innovations which are interoperable on a European scale.

The impact of the different policy options on innovation are assessed as follows:

- A relation exists between the level of GDP and the investment done in research and development (R&D). In general the higher the budget spent on R&D, the more likely innovations will be achieved. The GDP growth (see section 6.4.6) is therefore indirectly a measure for the impact on innovation.
- Another proxy for the impact on innovation is the level of implementation of the horizontal activities (River Information System, ERTMS etc.).

Level of GDP growth

The GDP cumulative effects in the Cross Border option are the highest, followed by the European Added Value, Corridor and Bottleneck option, as shown in Tables 6.13 and 6.14. This indirectly means that the highest impact on innovation is expected from the Cross Border option.

The maximum scenarios show a different result: the Corridor option scores the best, followed by the European Added Value, Cross Border and Bottleneck option.

Implementation of horizontal activities

Since almost all of the projects within the different policy options concern rail projects we will focus on the level of implementation of horizontal activities in the rail sector.

As previously mentioned, the EU is currently working on the European rail traffic management system (ERMTS) which is to create a European rail system composed of a single train signalling system that is standard throughout Europe. This standard train protection and management system will greatly simplify and speed up the technical interoperability of cross-border transport, raise safety standards and increases the capacity utilization of the existing rail network: an innovation in rail transport.

ERTMS not only provides (innovation) opportunities for a converging Europe, it can also turn out to be an innovative export success for the European rail industry. It is already a major export, since many rail companies - including some non-European ones - have decided to replace their obsolete systems with ERTMS. Current locomotive orders from Korea, Taiwan, India, Saudi Arabia and China, as well as infrastructure projects in those countries, are a clear measure of the market potential. ERTMS could become the world standard and an innovative export success if it can be built on a strong European market base[59].

Since financing of railway infrastructures by TEN-T funds is now bound to the compulsory installation of ERTMS, the different policy scenario's are 'judged' to their level of implementation of horizontal activities/innovation based on:

- The total number of TEN-T rail projects (all using ERTMS);
- The total number of rail projects that contribute to the realisation of the six ERTMS corridors (to reach a critical mass of transport corridors using ERTMS).

These 'judgment' criteria have also been used to determine the interoperability of the rail transport system in Europe. It can be concluded that the total number of (ERTMS) rail projects as well as the total number of rail projects that contribute to the realization of the six ERTMS corridors is the greatest in the Corridor-maximum and European Value Added-maximum policy option.

Combining the aforementioned impacts on GDP and horizontal activities as measure for innovation, it appears that in the minimum scenarios the Cross Border options scores the best (followed by the Corridor option) and in the maximum scenarios, the Corridor options has the highest score, with the European Added value option as second best.

6.6.3 Safety (accidents)

The best available proxy for the impact on safety is the information from the TEN-STAC report, i.e. the change in the monetary value of accidents. Due to the modal shift accomplished from road to rail (see section 6.4.6) a reduction of traffic injuries and fatalities can be expected. This change in the number of fatalities and injuries is multiplied with country specific values per fatality and injury.

[59] Source: http://www.michael-cramer.eu/english/146125.html

The greatest reduction in the monetary value of accidents in the period 2010-2025 arises in the European Added Value-maximum scenario.

Only in the Corridor policy option the monetary value of accidents in the maximum scenario is below that of the minimum scenario. This is due to the inclusion of the Fehmarn Belt fixed link (Denmark) in the maximum scenario. This fixed link is a multi-modal link and is expected to result in an increase of road passenger traffic as well and thus road accidents. This effect combined with relatively high costs of accidents in this region results in a rise of accident costs in this project. As a result the reduction in the total accident costs in the Corridor maximum scenario is below the reduction achieved in the Corridor minimum scenario.

Table 6.24 Changes in the monetary value of accidents in each of the policy options compared to the base case scenario (in mln Euro/year)

Policy options		Cumulative compared to base case	Change in the monetary value of accidents compared to the base case scenario (mln Euro /yr)	
		2010-2025	2015	2020
Corridor concept	Minimum	-620	-50	-30
	Maximum	-560	-50	-30
Cross-border focus	Minimum	-260	0	-28
	Maximum[a)]	-300	+2	-30
Bottleneck focus	Minimum	-580	-16	0
	Maximum[b)]	-590	-21	0
European Added Value focus	Minimum [c)]	-340	-22	-2
	Maximum[d)]	-760	-74	-30

Best minimum Best maximum

a) excl project Baudrecourt-Luxemburg since effects are not known
b) excl. projects Cambrai – Compiègne and Algeciras – Bobadilla since effects are not known
c) excl. projects Algeciras – Bobadilla, Prague – Linz, Napels - Messina and Frankfurt am Main – Rheidt/Duisburg since effects are not known
d) excl. projects Napels-Messina, Algeciras-Bobadilla, Prague-Linz and Frankfurt am Main – Rheidt/Duisburg since effects are not known

Based on TEN-STAC study

The total number of road fatalities in the EU25 has declined considerably in the last 15 years. In 1991 the total number of road fatalities arrived at approximately 71,000. In 2005 the total number of road fatalities arrived at 41,400. As described in The White paper the objective set is to halve the number of fatalities in the period 2001 – 2010, which means that by 2010 the number of fatalities should be reduced by 25,000. This reduction can be expressed in monetary terms using the 1 million Euro test (see explanation in the following box). In monetary terms the objective is a reduction of € 25 billion per year.

The estimated changes in the monetary value of accidents in the European Added Value maximum scenario is the highest, € 760 million in the period 2010-2025. The reduction on a yearly basis is € 50 million for the European Added Value maximum scenario. This

is approximately 0.2% of the objective to reduce the costs of (fatal) accidents by € 25 billion per year.

1 million Euro test

A reduction in road deaths can be expressed in monetary terms[60]. In that case costs like material damage, medical costs, loss of production, congestion costs, and immaterial costs can be taken into account.

Since it is not practical to calculate all these costs for every accident, the total socio-economic costs of traffic accidents are divided by the annual number of traffic deaths, assuming a constant ratio between accident with deaths, injuries and material damage. This computation method was introduced in 1997 by the European Commission in order to select cost-effective measures. Based on 1990 figures for all Member States the total costs per fatality turned out to be 1 Million Ecu (Commission of the EC, 1997); therefore the method is known since as the 1 Million Euro test. This value per fatality of course varies by country, since the share of fatal accidents and the total socio-economic costs of traffic accidents vary. However in calculation on a European scale, this average value can be used.

6.6.4 Security

Transport security has become an increasing political concern following terrorist attacks on Spanish and British transport systems in 2004 and 2005.The European Commission therefore launched several initiatives aimed at increasing the security level of transport and infrastructure. These initiatives originated in different Directorate-Generals of the European Commission, but were all mainly driven by a political concern to improve anti-terrorism measures, for example: security amendments to the Community Customs Code which require traders to provide customs authorities with information on goods before import to or export from the European Union.

It is not expected that the different policy options differ from each other with regard to security.

6.6.5 Impact on human resources and administrative costs

The administrative costs to be assessed for each policy options are defined as being the costs incurred by enterprises, the voluntary sector, public authorities and citizens in meeting legal obligations to provide information on their activities(or production), either to public authorities or to private parties[61]. Consequently, administrative cost reduction measures are limited to streamlining information requirements and do not affect the basic design of the underlying legislation.

[60] A reduction in either the number of accidents or the severity of accidents will result in lower direct as well as indirect costs.

[61] Commission working document COM92006) 691 final "Measuring administrative costs and reducing administrative burdens in the European Union

The administrative costs for the project promoters (Member States), once their project has been approved for MAP TEN-T financing, consists mainly of regular reporting to the Commission on technical and financial progress. It is noted that the costs that occur depend on the number and size of the projects; since the variation in the number of projects in the policy options is small and the overall TEN-T budget allocated is the same, no difference in these costs will occur.

The management of the MAP TEN-T will be carried out by the TEN Executive Agency (TEN-TEA)[62]. Once operational, the Agency will manage the Community funds available for the promotion of the TEN-T in close collaboration with DG TREN. The required staffing levels of the TEN-TEA are being studied in a separate study[63]. It is noted that, in terms of administrative costs incurred from the Commission, no difference between the policy options is recorded.

6.7 European added value

The term European Added Value is not clearly defined but in most EU sources it is closely related to subsidiarity. Added value is then the additional benefit arising from Community action that could not be achieved by one individual country alone.

In the context of the trans-European transport networks, this refers specifically to cross-border projects. The European Court of Auditors[64] recommends that:

"the Commission ... together with the Member States, gives priority to the financing of those TEN-T project sections, in particular cross-border project sections, whose completion is necessary if TEN-T is to achieve its European added value" (Page 4).

In its reply, the Commission confirms that:

"In order to achieve the European added value of the TEN-T programme, the Commission has to support cross-border projects as one of the eight priorities mentioned in the TEN-T guidelines of the European Parliament and the Council. The Commission and the Member States are in favour of increased support to cross-border projects. Since 2004, cross-border projects for works can receive a higher funding (up to 20 %), and a percentage of up to 50 % is foreseen in the new draft TEN Regulation" (Page 27).

If this definition of European added value of TEN-T projects is adopted, a **suitable indicator of the EAV of a project would be its European or cross-border effects**, i.e. all effects occurring not in the country in which the project is located but in adjacent or even far-away countries, either in absolute terms or as a percentage of its overall impact. The calculation of European or cross-border effects as defined is however problematic

[62] Created by the Commission's Decision (C(2006)5034 of 26 October 2006 in accordance with Council Regulation (EC) No.58/2003.

[63] An update is being carried out of the study "Cost Benefit Assessment of the Externalisation of the Management of Community Financial Support to the TEN-T networks, COWI (ECORYS Framework Contract), July 2005" reflecting the MAP TEN-T budget of 8 billion Euro.

[64] Special Report on the TEN-T networks (European Court of Auditors, 2005)

since it is not clear whether for a cross-border link between countries A and B the effects in A and B are to be counted. Moreover, in a multi-project scenario it is impossible to identify the contribution of a particular project. Therefore the impact on road and rail speeds of international (rather than interregional) trips as a measure of European Added Value is used.

Table 6.25 and 6.26 show the impacts of the policy scenarios on average travel speeds of international (rather than interregional) road and rail trips.

Table 6.25 Average speed of international road trips (kph), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	Average speed of international road trips (kph)						
		2006	2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	40.27	41.37	*+0.03*	*+0.20*	41.71	*+0.01*	*+0.05*
	Cross-border			*+0.17*	*+0.17*		*+0.04*	*+0.04*
	Bottleneck			*+0.05*	*+0.05*		*+0.01*	*+0.01*
	European AV			*+0.03*	*+0.03*		*+0.01*	*+0.01*
EU+15	Corridor	42.06	42.67	*+0.04*	*+0.24*	42.90	*+0.01*	*+0.06*
	Cross-border			*+0.20*	*+0.20*		*+0.05*	*+0.05*
	Bottleneck			*+0.06*	*+0.06*		*+0.02*	*+0.01*
	European AV			*+0.04*	*+0.04*		*+0.01*	*+0.01*
EU+12	Corridor	34.13	36.50	*+0.01*	*+0.07*	37.10	*+0.00*	*+0.02*
	Cross-border			*+0.07*	*+0.07*		*+0.02*	*+0.02*
	Bottleneck			*+001*	*+0.01*		*+0.00*	*+0.00*
	European AV			*+0.01*	*+0.01*		*+0.00*	*+0.00*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

Table 6.26 Average speed of international rail trips (kph), EU+27, EU+15 and EU+12, 2015 and 2020

Area	Scenario	2006	Average speed of international rail trips (kph) 2015			2020		
			Refer-ence	Min Δ%	Max Δ%	Refer-ence	Min Δ%	Max Δ%
EU+27	Corridor	30.43	32.85	*+0.68*	*+1.18*	34.52	*+0.78*	*+1.00*
	Cross-border			*+0.79*	*+1.28*		*+0.84*	*+0.92*
	Bottleneck			*+0.87*	*+0.87*		*+0.25*	*+0.25*
	European AV			*+1.54*	*+1.73*		*+0.79*	*+1.65*
EU+15	Corridor	32.66	35.67	*+0.85*	*+1.49*	37.52	*+1.02*	*+1.31*
	Cross-border			*+1.03*	*+1.67*		*+1.11*	*+1.22*
	Bottleneck			*+1.14*	*+1.14*		*+0.33*	*+0.33*
	European AV			*+1.98*	*+2.22*		*+1.01*	*+2.15*
EU+12	Corridor	23.60	24.37	*+0.17*	*+0.26*	25.37	*+0.04*	*+0.07*
	Cross-border			*+0.10*	*+0.10*		*+0.03*	*+0.03*
	Bottleneck			*+0.06*	*+0.06*		*+0.01*	*+0.01*
	European AV			*+0.21*	*+0.26*		*+0.13*	*+0.15*

Δ% = Difference to Reference Scenario (%) Best minimum Best maximum

A comparison of the impacts on road and rail speeds of international trips in Tables 6.25 and 6.26 with those of interregional trips in Tables 6.7 and 6.8 shows that the effects are rather similar. However, the largest effects on international rail speeds are associated with the European Added Value maximum scenario. The international effects would probably have been larger if also the bridge across the Fehmarn Belt would have been included in the European Added Value scenarios.

Another option is to use a rather simple definition/measure such as the **percentage of border crossing traffic relative to total traffic on a link under consideration**. This information can be extracted form existing O-D-matrices and resulting flow assignments used in network modelling exercises, both for passenger and freight, for road and for rail. A link could be considered with European Added Value for instance in case some 20-30% of traffic (vehicles, passengers, tonnes) are non-domestic.

6.8 Ranking of policy options

The comparison of the policy option is done based on a ranking system: for each identified impact scores are given to the options ranging from 4 (best score) to 1 (worst score) based on the previous chapters. In some cases policy options have identical scores. In the following two tables, the ranking of the policy options is presented:

Table 6.27 Ranking of TEN-T policy options (**minimum** number of projects) (4=best score, 1=worst score)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
Economic impacts				
Yearly contribution needed from Governments, EIB loans and PPPs	3	4	2	1
Public Private Partnerships	-	-	-	-
Travel time savings passengers				
Saved hours per trip/year	2	2	2	4
Total saved hours	4	1	3	2
Transport costs savings freight	3	4	2	2
Accessibility				
Average speed interregional road trips	2	4	3	2
Average speed interregional rail trips	2	3	1	4
Competitiveness				
GDP per capita	2	4	1	3
Cumulative GDP	2	4	1	3
Territorial cohesion				
Gini coefficient accessibility	3	2	2	4
Gini coefficient GDP	3	1	3	4
Reduction of road congestion	4	1	3	2
Modal shift				
Freight	4	3	1	2
Passengers	4	1	2	3
Interconnectivity en interoperability	2	4	1	2
Environmental impacts				
Emissions				
NOx	2	4	3	1
Particulates	3	4	2	1
Climate (CO2)	4	3	1	2
Social impacts				
Employment	-	-	-	-
Innovation	3	4	2	2
Safety	4	1	3	2
Security	-	-	-	-
Human resources and administrative costs	-	-	-	-
TOTAL SCORE	**56**	**54**	**38**	**46**
European Added Value				
Average international rail and road speed	2	4	1	3
Share international traffic	N.A.	N.A.	N.A.	N.A.

NOTE1: All rankings are based on cumulative effects period 2010-2025 for EU+27, except Accessibility, Competitiveness and Territorial Cohesion which are based on the year 2020.

NOTE2: - = no difference between the policy options, N.A. = not available

Table 6.27 reveals that in the minimum scenarios, the Corridor option scores overall the best, followed closely by the Cross-border option. The European Added Value option scores third and the Bottleneck option is the least preferred option.

The difference between the Corridor and the Cross-border option is among others caused by the higher number of passenger time savings per trip combined with a higher number of passengers. The score "total saved hours" (4) for the Corridor is higher compared to the Cross-border option (1). Interestingly, the "transport cost savings" in the Cross-border option is the highest (4).Therefore, it is concluded that the projects in the Cross-border option have on average lower passenger flows and higher freight flows compared to the other options.

If the environmental impacts are assessed, it becomes clear that the score for the Cross-border option is the highest of all options. Apparently, the additional pollution of the combination of the higher freight flows does outweigh the lower emission levels of the lower number of passenger flows, leading to in total lower environmental damage.

The European Added Value option scores, as expected, high on the impact on territorial cohesion. This is due to the fact that cohesion has been one of the criteria to select projects. This option does score low on total passenger time saved and freight transport cost savings, although the average time savings per trip is rather high. This is caused by relatively low traffic flows, which also becomes clear in the low score on environmental impacts. The separate criterion "European Added Value" could be quantified using only one instead of the proposed two aspects. Nevertheless it is interesting to note that the European Added Value policy option scores relatively low on this criterion.

Table 6.28 Ranking of TEN-T policy options (**maximum** number of projects) (4=best score, 1=worst score)

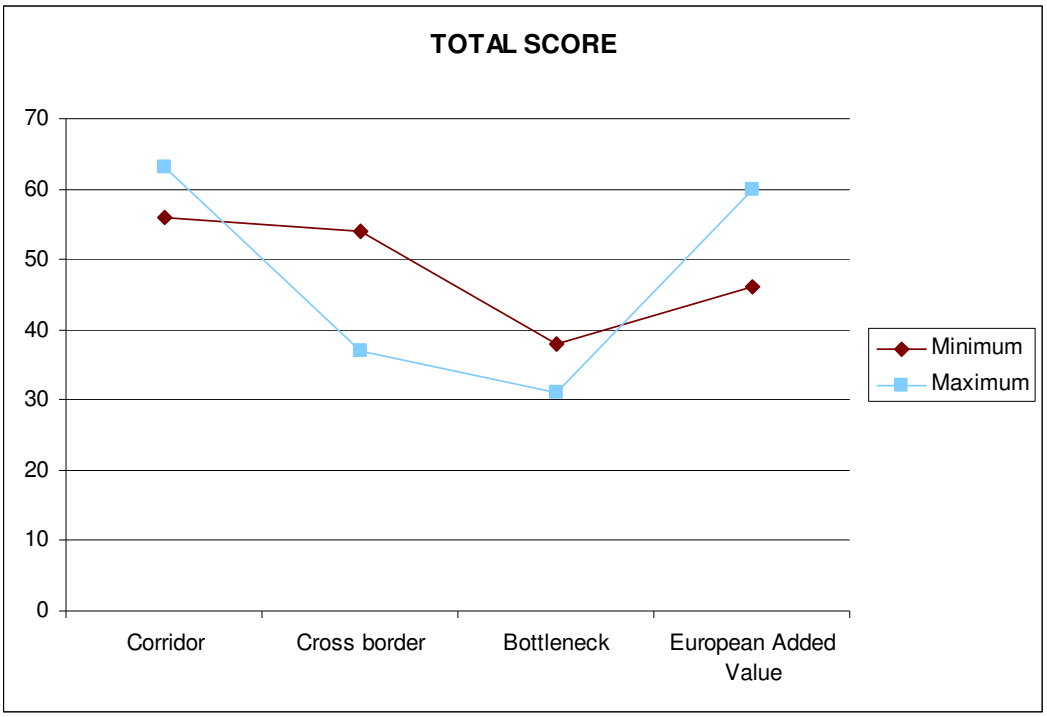
Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
Economic impacts				
Yearly contribution needed from Governments, EIB loans and PPPs	2	3	4	1
Public Private Partnerships	-	-	-	-
Travel time savings passengers				
Saved hours per trip/year	3	1	2	4
Total saved hours	3	2	2	4
Transport costs savings freight	4	2	1	3
Accessibility				
Average speed interregional road trips	4	3	2	1
Average speed interregional rail trips	3	2	1	4
Competitiveness				
GDP per capita	4	2	1	3
Cumulative GDP	4	2	1	3
Territorial cohesion				
Gini coefficient accessibility	3	2	1	4
Gini coefficient GDP	2	1	3	4
Reduction of road congestion	4	1	2	3
Modal shift				
Freight	3	2	1	4
Passengers	3	1	2	4
Interconnectivity en interoperability	4	3	1	2
Environmental impacts				
Emissions				
NOx	4	2	1	3
Particulates	4	3	1	2
Climate (CO2)	3	2	1	4
Social impacts				
Employment	-	-	-	-
Innovation	4	2	1	3
Safety	2	1	3	4
Security	-	-	-	-
Human resources and administrative costs	-	-	-	-
TOTAL SCORE	**63**	**37**	**31**	**60**
European Added Value				
Average international rail and road speed	4	2	1	3
Share international traffic	N.A.	N.A.	N.A.	N.A.

NOTE1: All rankings are based on cumulative effects period 2010-2025 for EU+27, except Accessibility, Competitiveness and Territorial Cohesion which are based on the year 2020.

NOTE2: - = no difference between the policy options, N.A. = not available

When comparing the minimum and maximum scenarios (Table 6.28), it is clear that the Corridor option scores best in both scenarios. The European Added Value options scores better in the maximum scenario (overall rank 2) than in the minimum scenario (overall rank 3). The higher score for the European Added Value scenario results from higher scores on the economic impacts, freight transport cost savings and modal shift. The higher modal shift also leads to lower emissions and a higher score on environmental impacts.

Figure 6.4 Ranking of the policy options in minimum and maximum scenario



It is noted that, in relative terms, the Cross-border option scores less well in the maximum scenario. This might be caused by the fact that, by selecting more projects i.c. also projects that score less on the selection criteria, concessions have been done on the efficiency of projects. This is the case for all options, but apparently this efficiency effect is more visible for Cross-border projects.

6.9 Sensitivity Analysis

A sensitivity analysis has been performed regarding the acceleration effects. In section 5.2.2 it is described that (a type of) focussed TEN-T support is assumed to speed-up the realisation of the total TEN-T network. Assumptions have been made on the (amount of years) earlier realisation of type of projects. In the sensitivity analysis variations to the assumed acceleration effects are made:

- Cross-border projects will on average be realised **5 years** earlier (instead of 3);
- Bottleneck sections will on average be realised **1 year** earlier (instead of 2);
- The wider time gains for the whole corridor are unchanged and remain 1 year.

The result of the sensitivity analysis for the ranking of the policy options is listed in the next two tables.

Table 6.29 Ranking of TEN-T policy options after increasing the acceleration to 5/1 year(s) (**minimum** number of projects) (4=best score, 1=worst score, in *italics* the difference with the base case)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
SENSITIVITY CASE				
Economic impacts	40 *(.0)*	44 *(+6)*	21 *(-6)*	39 *(+1)*
Environmental impacts	10 *(+1)*	11 *(0)*	4 *(-2)*	5 *(+1)*
Social impacts	7 *(.0)*	6 *(+1)*	3 *(-2)*	5 *(+1)*
TOTAL SCORE	**57 *(+1)***	**61 *(+7)***	**28 *(-10)***	**49 *(+3)***

NOTE1: The sensitivity of the (economic) impacts on Accessibility, Competitiveness and Territorial Cohesion has not been separately analysed. The tendency that the Cross-Border scenario scores better and the Bottleneck worse would otherwise be reinforced.

The obvious observation from the above table is that the Cross-border option gains the most and consequently also scores as the best option. This is however not a surprise since all projects in this option are accelerated, whereas for the other options only part (or no) projects are realised earlier. The higher score is almost completely on the expense of the Bottleneck option which scores less well. The other two options are rather stable.

The results of the sensitivity analysis for the maximum (number of projects) scenarios are shown in the following table.

Table 6.28 Ranking of TEN-T policy options after increasing the acceleration to 5/1 year(s) (**maximum** number of projects) (4=best score, 1=worst score, in *italics* the difference with the base case)

Policy option Impact on (in period 2007-2013)	Corridor	Cross-border	Bottleneck	European Added Value
SENSITIVITY CASE				
Economic impacts	48 *(+2)*	32 *(+5)*	20 *(-4)*	42 *(+1)*
Environmental impacts	11 *(0)*	8 *(+1)*	3 *(0)*	8 *(-1)*
Social impacts	7 *(1)*	4 *(+1)*	2 *(-2)*	7 *(0)*
TOTAL SCORE	**66 *(+3)***	**44 *(+7)***	**25 *(-6)***	**57 *(-3)***

NOTE1: The sensitivity of the (economic) impacts on Accessibility, Competitiveness and Territorial Cohesion has not been separately analysed. The tendency that the Cross-Border scenario scores better and the Bottleneck worse would otherwise be reinforced.

The increase of acceleration (sensitivity analysis) for the maximum scenarios shows that the Corridor option remains the best option followed by the European Added Value option. The ranking of options is the same compared to the base case situation.

The sensitivity analysis shows that the ranking of the options rather sensitive for the assumption on the average acceleration effects in the minimum scenarios only. It is concluded that in general the Corridor option is the most favourable option.

6.10 Other acceleration elements

In chapter 5 it was mentioned that basically three dimensions do play a role when considering ways to increase the speed of implementation of TEN-T projects:

- Type of projects to be (co-)financed
- Distribution of the budget between works and studies
- The impact of the MAP on the maximisation of other financial sources available

These dimensions are complemented with the TEN-T co-financing rate. A higher co-financing rate is likely to have a higher impact on the acceleration of a project, compared to a lower rate.

The first point has been addressed in the previous sections; the other three are described in this section.

Distribution of the budget between works and studies

The distribution of the MAP budget between works and studies relates to the previously stated importance of project preparation (see chapter 2). The reasons for delayed implementation of transport infrastructure projects are manifold, it is however clear that well prepared projects will face less delay.

Maximising other financial sources

If projects are prepared well, this is expected to attract more private investment since these projects are bankable and will have (in general) a reduced risk profile. Secondly EIB's Loan Guarantee Instrument (section 6.4.2) is also expected to create a high leverage effect, especially if projects are well prepared.

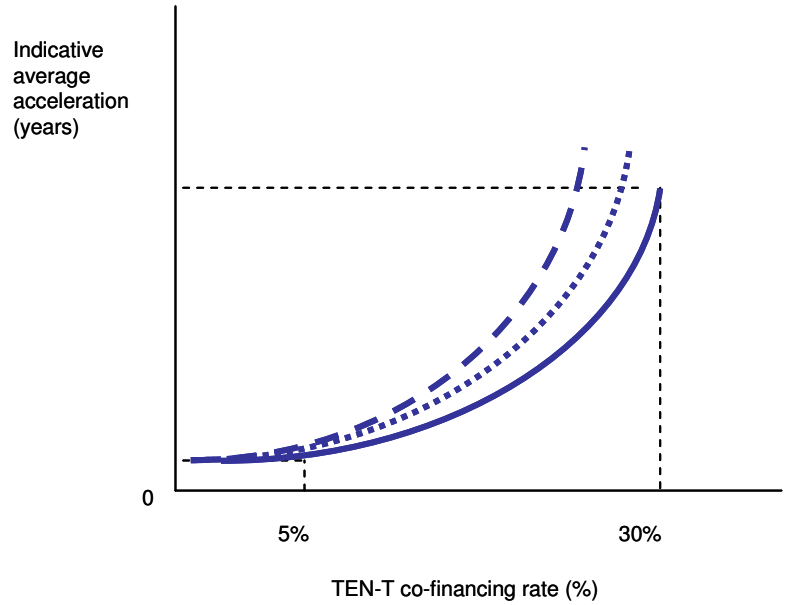
The impact of high quality project preparation on the implementation period is as difficult to estimate as the impact of focussed support. However, based on above considerations there is no reason to assume that the acceleration deviates significantly from the impact of focussed financial means. Therefore, an additional average acceleration of 2 years for Bottleneck and 3 years for Cross Border projects; leading to additional benefits, is not unlikely.

Level of TEN-T co-financing rate

Obviously a relation exists between the level of the co-financing rate and the potential acceleration effect of the implementation of a TEN-T project. In case of a low co-financing rate (<10%) it is confirmed through the stakeholder consultation that the TEN-T finance does not make a clear difference in terms of bringing projects forward in time. However, if the co-financing rate is higher than a certain threshold an impact on the speed of implementation could be measured.

This saturation effect is illustrated in the next figure.

Figure 6.5 Relation between level of TEN-T co-financing rate and acceleration (illustration)



The statistical basis to assess the exact shape of the curve is lacking, therefore several curves are presented in the picture above. No clear evidence exists on the impact of the level of co-financing rate on the acceleration of project implementation. Nevertheless, a general trend of decreasing marginal benefits is expected to be valid.

6.11 Cost-Benefit Analysis

6.11.1 Introduction

The ranking of policy options, according to the above Multi-Criteria Analysis (MCA), is complemented with a (partial) socio-economic Cost-Benefit Analysis (CBA) in accordance with the EC Guidelines on conducting CBAs[65].

The CBA answers the question if a public investment in a project is justified taken all economic costs and benefits for society into account from a welfare economic point of view. The Costs and Benefits are all expressed in monetary (or money) terms and are to be assessed as the difference between the policy option(s) and the reference scenario. The present CBA analyses the impacts of the policy options on EU+27 level.

In this CBA the following categories of benefits are assessed in monetary terms:

- Direct impacts. These impacts directly relate to the policy options and occur within the transport market. This includes:
  - Capital expenditures
  - Travel time savings passengers

[65] Guide to Cost-Benefit Analysis of investment projects, Evaluation Unit DG Regional Policy European Commission, 2002

    - Transport cost savings freight
    - Reduction of road congestion.
- External impacts. These are impacts on markets not directly related to the transport market:
    - Reduction of NOx emission
    - Reduction of CO_2 emission
    - Reduction of particulates emission
    - Improvement of traffic safety

Besides these impacts, wider (or indirect) economic impacts occur as a result of the better accessibility of regions. These wider impacts concern for example impacts on employment and productivity. Although information has been gathered on these impacts, this is not detailed enough to take into account in this CBA. Therefore, it is assumed that these indirect economic impacts are equal to 30% of the direct impacts[66].

Obviously the Costs and Benefits of the options occur at different periods in the project; construction only lasts for a couple of years, the operational period will take a much longer timeframe after the construction is completed. It is well known that tomorrow's money is of less value compared to today's money. Therefore all Costs and Benefit flows are discounted using a social discount rate of 5%, in line with the recommendations made in the EC CBA Guide. The social discount rate reflects the social view on how future benefits and costs should be valued against present ones.

The period taken into account is 2007-2025. It is noted that after 2025 no net benefits will accrue since by then no difference exists anymore between the implemented projects in the policy options and the reference.

The CBA is conducted for the policy option with the highest score in the impact assessment namely the Corridor policy option (minimum scenario only).

6.11.2 CBA results

Costs

The costs (or capital expenditures) to be financed from the MAP TEN-T of the Corridor policy option amount to € 4,839 million. This amount is spent on the projects included in the option, on average, 3 years earlier (acceleration effect) compared to the situation without the MAP TEN-T (reference scenario).

It should be mentioned that the substantial amount of additional investment (from national sources, loans and PPP's) equal to € 16,234 million is also needed to actually realise these projects earlier.

This policy option includes an acceleration effect, which means that the costs for the construction of the projects are made earlier in time compared to the situation without the MAP TEN-T. The net capital expenditures are thus composed of interest costs, since in

[66] This rule-of-thumb is the result of CBAs of transport infrastructure in the Netherlands. This assumption is in line with international practice as well.

the reference situation the money is spent 3 years later in which interest is received. The net capital expenditures are equal to **€ 2,372 million** (Present Value).

Benefits

The Benefits are calculated using the information from the previous sections. In order to transfer the time savings, tonnes of NOx emissions etc. the recently concluded study HEATCO[67] is used. This study provides information on valuation of these benefits in money terms for a substantial number of EU countries. These values have been used to estimate EU+27 values.

The Benefits, in Net Present Values are as follows:

- Time savings passengers € 1,980 million
- Cost savings freight transport € 337 million
- Cost savings due to reduction of road congestion € 257 million
- Reduction of NOx emission € 9 million
- Reduction of CO_2 emission € 237 million
- Reduction of particulates emission € 1 million
- Improvement of traffic safety € 307 million
- Indirect economic impacts € 772 million

The total (rounded) Benefits amount to **€ 3,900 million** (Present Value)

Internal Rate of Return and Benefit Cost Ratio

The result of the CBA is expressed in an Internal Rate of Return (IRR) and the Benefit Cost Ratio. The IRR is equal to **7.4%** which convincingly outweighs the required threshold being the social discount rate of 5%[68] representing a risk free interest rate to be received in case no investment is done. This means that from a socio-economic point-of-view this policy option is feasible. The Benefit Cost Ratio equals **1.6** which means that each Euro spent generates 1.6 Euro socio-economic benefits to the EU+27 consisting of travel time savings, transport cost reductions and reduction of pollution.

One should bear in mind that this is a conservative estimate. The Benefit Cost ratio of the maximum scenario will in all cases be higher.

6.11.3 Impact of scaling up of the MAP TEN-T budget

The CBA shows favourable results for the Corridor policy option based upon the allocated financial envelop of the MAP TEN-T. An interesting question to be answered is whether (significantly) scaling up the budget would lead to similar Benefit Cost Ratios.

The mechanism to select projects for the policy options (see chapter 5) entails that only the best performing projects, according to certain selection criteria, are to be included. This implicitly means that each additional project will have a lower added value compared to the already selected projects (lower marginal benefit). Thus, it is expected

[67] Developing **H**armonised **E**uropean **A**pproaches for **T**ransport **Co**sting and Project Assessment (HEATCO), EC 6th Framework Programme, December 2005

[68] Ibid

that scaling up the MAP TEN-T budget will lead to a lower Internal Rate of Return and Benefit Cost ratio as compared to the previously presented values. No detailed assessment could be made of the impact of an increased MAP TEN-T budget on the overall Rate of Return.

6.12 Conclusions

Corridor option has the highest score in Multi-Criteria Analysis

The Corridor policy option scores the best in both the minimum and maximum scenario, followed by respectively the Cross Border option in the minimum scenario and the European Added Value scenario in the maximum scenario.

It is important to acknowledge that the policy options, and especially the selection methodology and resulting projects constituting the options, do have the function to serve as illustration. It might well be that the Commission proposes to select other projects in the scenarios. Moreover, in reality it is not likely that the options would exactly be realised. Nevertheless, the general observation is that focussed TEN-T support on especially completing Corridors and realising Cross Border projects will generate higher impacts compared to other focussed support.

Scores are rather sensitive to assumptions on acceleration effect

The sensitivity analysis carried out on the assumptions for acceleration shows that the Cross Border option is performing significantly better in case the projects are implemented 5 years earlier. The Cross Border option is even ranked first in the minimum scenario. Not surprisingly, the Bottleneck option is scoring less well since the projects selected in this option are not further accelerated. The other two options are rather stable.

Favourable Rate of Return and Benefit Cost ratio

The Cost Benefit Analysis is conducted for the minimum scenario of the Corridor policy option. The Rate of Return is 7.4% which convincingly outweighs the social discount rate of 5% meaning that, from a socio-economic point-of-view, this policy option is feasible. The Benefit Cost Ratio equals 1.6 which means that each Euro spent generates 1.6 Euro socio-economic benefits to the EU+27.

One should bear in mind that this is a conservative estimate. The Benefit Cost ratio of the maximum scenarios will in all cases be higher.

Scope for scaling up of MAP TEN-T budget

It is expected that scaling up the MAP TEN-T budget will lead to a lower Rate of Return and Benefit Cost ratio as compared to the previously presented values. In case of scaling up of the budget sufficient administrative capacity both at Commission and Member States level to efficiently use these budgets is required.

7 Quantification of programme budget

7.1 Introduction

It is noted that in the definition of policy options, a total amount of € 6.4 to € 6.8 billion has been used for the MAP TEN-T budget for the period 2007-2013. This has been the most recent information on actual budget allocation used in this ex ante evaluation.

In the framework of this ex-ante evaluation an independent estimation of the MAP TEN-T budget needed until 2020 has been carried out. This chapter focuses on the quantification of the MAP TEN-T budget needed until 2020. A distinction is made between the present 2007-2013 programming period and the period beyond 2013. It concerns priority projects only; the realisation of the complete TEN-T network is beyond the scope of this exercise.

Besides the budgetary requirements, other elements in the sphere of administrative capacity (at Member State and Commission level), proper project preparation and management are important to address for successfully using the estimated budgets.

7.2 Estimation financial needs

7.2.1 Period 2007-2013

Our estimation of the MAP TEN-T budget needed is based on the most recent information on progress and cost, which was has also been used in our selection of project in the policy options.

It should be remembered that a couple of important assumptions are made:

- The maximum co-financing rates according to the Financial Regulation are applied[69]
- The calculation is based on the costs estimated in the most recent TEN implementation report (2005)
- The calculation only focuses on works on the TEN priority projects, excluding horizontal actions, Galileo and other TEN projects, but including projects in all Cohesion Fund countries
- The distribution of costs is supposed to be linear in time for all projects

[69] 20% co-financing in priority projects; 30% co-financing in cross-border projects and natural barriers; 10% co-financing in other projects.

- Cost information is missing on a couple of projects; therefore no costs could be considered for these projects

Based on above assumptions it is estimated that in total **€ 21.3 billion** is needed for works in the period 2007-2013 for **all** priority projects to be financed from the MAP**.** This is clearly much higher than the allocated amount of € 4.9 billion and corresponds to the systematic of the policy options of including only a selection of priority projects to be co-funded.

The estimated other sources of finance (national budgets, Cohesion Fund, loans and PPPs) would need to be at least **€ 86.7 billion** for the priority projects only to complement the estimated MAP TEN-T budget. The total financial requirement for all priority projects in the period 2007-2013 is thus **€ 108.0 billion**.

7.2.2 Beyond 2013

Not all priority projects are expected to be implemented in 2013, some also need (significant) financial support in the forthcoming programming period 2013-2020. It is not unlikely that even beyond 2020 TEN-T budget is needed.

If the same calculation method is used; an estimated **€ 15.8 billion** for works on the priority projects is to be covered by the next MAP TEN-T.

The other sources of finance would account for at least **€ 60.6 billion** for the priority projects only to complement the estimated MAP TEN-T budget. The total financial requirement beyond 2013 is thus **€ 76.4 billion**.

7.2.3 Total financial needs

The aforementioned financial calculations add up to a total of € 184.4 billion for the works on all priority projects (except horizontal actions and Galileo). This is less than the € 252 billion mentioned in section 2.4.2.

This is due to several reasons:
- Incomplete cost information
- No provision taken into account for necessary studies

7.3 Prerequisites for successful spending

The above estimated amounts of finance needed have been calculated in a rather mechanical way without consideration of other prerequisites to realise the TEN-T network. The problem analysis (chapter 2) indicated that, besides the budgetary constraints, there are basically two other main reasons for the rather slow speed of implementation of the TEN-T network to date:
- A lack of or inefficient cross-border cooperation
- Poor project preparation and poor administrative and technical management

Cross border cooperation

The lack of well established cross border cooperation is amongst others due to conflicting EU and national needs. Bringing in additional EU funds is only part of the solution, since Member States will be required to co-finance (in most case) the majority of the projects. Therefore, it remains important to seek for common interests in any TEN-T priority project. The formal willingness for cooperation between Member States could for instance be laid down in Memoranda of Understanding and cross border project organisations.

The European Coordinators have already proved to be instrumental in putting projects forward, by means of bringing the key stakeholders together and actively search for common interests. With increasing budgets, it is recommended to further strengthen the role of the Coordinators.

Project preparation, implementation and management

Clearly, the focus of the MAP TEN-T is on realising projects by financing works; only a minor part of the budget is to be used for project preparation studies. The impact of high quality technical, economic, financial and environmental feasibility studies should not be underestimated.

If a project is well prepared (major) delays in the actual implementation could be avoided. Secondly, better project design, implementation and management is likely to lead to an increase in private investment (PPP). If more bankable projects are available, it is likely that the investment from private investors will increase.

7.4 Conclusions

Estimated financial requirement 2007-2013

It is estimated that in total € 21.3 billion is needed for works in the period 2007-2013 for all priority projects to be financed from the MAP. This is clearly much higher than the actual allocated amount of € 4.9 billion.

The estimated other sources of finance (national budgets, Cohesion Fund, loans and PPPs) would need to be at least € 86.7 billion for the priority projects to complement the estimated MAP TEN-T budget. The total financial requirement in 2007-2013 is thus € 108.0 billion.

Estimated financial requirement beyond 2013

Not all priority projects are implemented in 2013, some also need (significant) financial support in the forthcoming programming period 2013-2020. If the same calculation method is used this results in an estimated € 15.8 billion for works on the priority projects to be covered by the next MAP TEN-T.

The other sources of finance would account for at least € 60.6 billion for the priority projects only to complement the estimated MAP TEN-T budget. The total financial requirement beyond 2013 is thus € 76.4 billion.

8 Future monitoring and evaluation

8.1 Introduction

In the framework of the MAP TEN-T 2007-2013, a monitoring and evaluation system is needed in order to verify whether implementation is 'on track' and to what extent the policy is achieving its set objectives.

In the context of the reform process launched in 2000, the Commission acknowledged the need for more results-focused management and decided, inter alia, to further develop evaluation activities. This process has led to a set of requirements on evaluation that applies to all policy areas. These requirements are set out in a number of documents:

- The Financial Regulation[70]
- The implementing rules of the Financial regulation[71]
- The Communication on Evaluation[72], and
- The Communication on Evaluation Standards and Good Practices[73]

Evaluation and monitoring are not the same. Monitoring is a continuous and systematic process carried out during the duration of an intervention. The intention is to correct any deviation from the operational objectives and thus improve the performance of the programme. Monitoring usually does not provide answers on the results and impacts of interventions, since this is part of evaluations. Evaluations can take the form of both ex-ante, interim or ex-post evaluations.

This chapter briefly outlines the operational objectives and proposed indicators for the MAP TEN-T 2007-2013.

8.2 Objectives and evaluation indicators

As mentioned above, measurable indicators should be identified to evaluate the results of the proposed intervention. The definition of the indicators is of course very closely related to definition of the objectives. The indicators are the translation of the objectives into measurable outcomes, serving as a basis for measuring achievements. The indicators have some requirements and should be 'RACER', i.e.[74]:

[70] Council Regulation 1605/2002, articles 27, 28 and 33
[71] Commission Regulation 2342/2002, art 21
[72] SEC(2000)1051
[73] SEC(2002)5267
[74] European Commission, 2005, Impact Assessment Guidelines, Brussels

- **R**elevant, i.e. closely linked to the objectives to be reached
- **A**ccepted (e.g. by staff and stakeholders)
- **C**redible for non-experts, unambiguous and easy to interpret
- **E**asy to monitor (e.g. data collection should be possible at low cost)
- **R**obust against manipulation

As stated in the new guidelines for Impact Assessment, at this stage of the policy cycle one needs to focus on the indicators for the key policy objectives. These have already been developed in chapter 3 and seem valid for the future monitoring of the implementation of a new institutional framework.

Monitoring indicators

As mentioned above, measurable indicators will be identified to evaluate the results of the proposed intervention. In cooperation with relevant bodies of the sector, methods of data collection will need to be defined and agreement between all parties in the sector on the soundness and reliability of the proposed collection methods is beneficial.

At present there are six European coordinators appointed by the Commission to ensure effective and timely implementation of prioritized TEN-T projects. The six coordinators promote the projects amongst private investors and financial institutions and keep the EU informed of progress.

Currently DG TREN is working on a revision of project reporting procedures and the creation of a TEN-T Executive Agency. Also more staff is allocated to TEN-T project management.[75]

Plans for evaluation

In order to ensure that all EU activities are reviewed and that lessons learned are fed back into the decision making process, all action programmes must be evaluated according to the *Impact Assessment Guidelines*. Evaluation could be done by analysing the collected data on the indicators annually and review whether trends observed fit within the objectives set (e.g. is the trend going towards the objective aimed at? Is it following this trend in the aimed progress or is it lagging behind? etc.) It is important to agree on who is responsible for carrying out the evaluations. Recommendations from the (annual) monitoring and evaluation can be used to test whether the current evaluation plan is still appropriate.

Finally it can be mentioned that DG TREN, in reaction of a report by the European Court of Auditors on TEN-T, has started with the definition of TEN-T evaluation guidelines[76].

Recommendations

Based on aforementioned it is recommended that DG TREN starts monitor the indicators belonging to the operational objectives of the MAP TEN-T (see table 8.1)

[75] 'Information note of the European Court of Auditors on Special Report No6/2005 on the trans-European network for transport', Luxembourg 20 April 2006, Reference ECA/06/8.

[76] Source: see previous footnote.

Table 8.1 Operational objectives and proposed indicators MAP TEN-T (initial, non-exhaustive list)

Objectives	Indicators
Operational objectives	
• To improve project preparation	• Quality of project applications • Quality and number of risk assessments included • Number of TEN-T investment plans that start without delay
• To improve coordination between countries	• Number of cross-border projects realised • Number of integrated cross-border planning schemes
• To increase the sense of urgency	• National budgets allocated to TEN-T
• To optimise the use of financial instruments, stimulating attracting additional finance (PPP)	• Number of and amount of private funds attracted

9 Conclusions and recommendations

9.1 Conclusions

The support through a MAP for the priority TEN-T projects provides added value in terms of realisation of projects. In particular cross-border projects face difficulties in terms of allocation of enough national funding to make these projects happen. The support from the Commission is therefore welcomed and it is recommended to continue this support.

Through concentrating the MAP TEN-T budget on completing pan-European corridors by a mix of cross-border and bottleneck projects situated on the predefined priority axes/projects ("Corridor concept"), it is expected that the overall implementation of the TEN-T will be accelerated compared to a more scattered allocation of resources. This acceleration has a net positive impact on the EU's economy since benefits from a more efficient transport system will occur earlier in time and these benefits outweigh the costs. The rate of return of the Corridor concept is equal to 7.4% which convincingly outweighs the social discount rate of 5% meaning that, from a socio-economic point-of-view, this option is feasible. The Benefit Cost Ratio equals 1.6 which means that each Euro spent generates € 1.6 socio-economic benefits to the EU+27.

Based on the calculations it is concluded that the present MAP TEN-T budget for works in the period 2007-2013 is not enough as compared to the actual estimated need in this period. A potential increase of the budget could be made dependent on the speed of absorption of the present budget. Such an increase will have a net positive socio-economic effect for the EU+27.

A distinction has been made in the recommendations between recommendations aimed at the European Commission, more in particular DG TREN, and the Member States.

9.2 Recommendations Commission level

Aim for concentrated MAP TEN-T support

It is advised to concentrate the limited MAP TEN-T budget for the period 2007-2013 on completing (cross-border and bottleneck) sections of main corridors ("Corridor concept") situated on the priority projects. This approach will provide added value compared to a more scattered allocation of resources. The TEN-T Executive Agency should play an active role in ensuring the concentrated support.

Create political support amongst Member States

If concentrated support were to be applied, this directly means that not all countries will be served equally in terms of financial support from the MAP. It is expected that such a choice will lead to (some) resistance amongst Member States. Therefore, it is recommended to actively invest in creating acceptance from Member States, through for example highlighting the accomplishments by use of best practice examples of cross-border projects and corridor completion. The Commission should in our view continue to support the valuable work of the European Coordinators.

Monitor and evaluate the speed of implementation

The speed of implementation of projects in the 2007-2013 period should be monitored in order also to understand better the relation between concentrated support and acceleration. More effort should be devoted to the systematic collection of empirical information on reasons for delay of projects.

Importance of EIB as core partner

A close collaboration with the EIB is deemed necessary to encourage the selection of mature TEN-T projects for finance and subsequent implementation. It is recommended that the EIB actively promotes the Loan Guarantee Scheme in order to stimulate PPPs. This is a promising instrument for bridging the financial gap that exists between the actual needs and the available funds for the completion of the whole TEN-T priority project network.

Prerequisite for potential MAP TEN-T budget increase

Based on our calculations it is clear that the present MAP TEN-T budget for works in the period 2007-2013 is not enough as compared to the actual need in this period. A potential increase of the budget could in our view be made dependent on the speed of absorption of the present budget.

Need for comparable study addressing Cohesion Fund countries

The present ex-ante evaluation, for the purpose of the study, mainly looked at the countries which are not eligible for the Cohesion Fund. It is recommended to assess also the economic, environmental and social impacts of forms of concentrated support of the Cohesion Fund.

9.3 Recommendations Member State level

Improve project preparation, implementation and management

It is generally acknowledged that project preparation, implementation and management of large transport projects could be (substantially) improved in order to decrease delays. This is also relevant for TEN-T projects. Project promoters in the Member States are thus advised to invest in improving these elements. It should be noted that part of the MAP TEN-T budget could be spent on studies, thus helping improving project preparation.

Formalise willingness to cooperate on cross-border projects

There is a need to try to ensure that cross-border TEN-T projects will continue to get (political and financial) support from the respective Member States after change of (key)

decision makers. This is already made effected through Memoranda of Understanding and the set-up of cross-border project organisations which is obligatory for financially divided cross-border projects according to the TEN-T Guidelines.

Annex 1: List of stakeholders consulted

TEN-T priority projects (interviews)	Name
Railway axis Berlin-Verona /Milan-Bologna-Naples – Messina -Palermo »	Karel Van Miert
Railway axis of South-west Europe »	Etienne Davignon
Railway axis Lyon-Trieste-Divaca/Koper-Divaca-Ljubljana-Budapest- Ukrainian border »	-
Railway axis Paris-Strasbourg-Stuttgart-Vienna-Bratislava »	Péter Balázs
Railway axis «Rail Baltica» Warsaw - Kaunas - Riga – Tallinn –Helsinki"	Pavel Telicka

European organisations (interviews)	Name
UIC	Gerard Dalton
EIA	Klaus Ebeling
INE	Karin de Schepper

NOTE: EIM's response to the questionnaire was based on position papers, no additional interview took place.

No interview could take place with the IRU within the timeframe of this study.

Other stakeholders (questionnaires)	Name
TEN-T Financial Committee - Member State representatives	-

Annex 2: Project selection methodology

Introduction

In this annex the selection of the projects that are included in each of the policy options (as identified in chapter 5) is further explained. The policy options under consideration are:

- **Option 1 "Corridor concept"**: A mix of cross-border and bottleneck projects situated on the priority axes/projects.
- **Option 2 "Cross-border focus"**: Only cross-border projects situated on the priority axes/projects. This includes Motorways of the Sea projects.
- **Option 3 "Bottleneck focus"**: Only bottleneck projects situated on the priority axes/projects.
- **Option 4 "European Added Value"**: Any project of high European Value Added situated on the priority axes/projects.

Each policy option consists of a **maximum** and **minimum** scenario. In the maximum scenario, the maximum co-financing rates per type of project apply, whereas in the minimum scenario the co-financing rate is only half of the maximum. The next sub-sections describe and visualise the selection procedure for each of the policy options.

There are number of important assumptions underlying the chosen method to select the projects:

- Only projects that are part of the thirty priority axes are included. An important source of information about these axes and projects was the report "Trans-European transport Network: TEN-T priority axes and project 2005"
- The total amount of required co-financing (from national budgets or other sources) is available.
- The projects that are selected in the policy options, and are financed partly from the TEN-T budget, are sped up with a number of years. This acceleration effect of the TEN-T budget is the only effect that will be taken into account.
- The projects that are **not** selected in the policy options are still implemented, but are not sped up.
- The amount available from the TEN-T budget for construction of infrastructure is between € 4.5 billion and € 4.9 billion (as explained in chapter five). The upper limit of € 4.9 billion is used for the selection of projects

Option 1 "Corridor concept"

The selection of projects within this policy option is done by starting from the total list of projects situated on the thirty priority axis of the TEN-T. After excluding projects that are finished or already under construction for the remaining projects values on a number of indicators are calculated. The values on the first three indicators are based on data available through the TEN-STAC study:

- Travel time savings per passenger [mln hours per year]. This indicator is expressed in time saved due to improved transport connections.
- Passenger traffic flows [passengers per year]. This represents the estimated number of passengers per year, providing an indicator for the weight of the bottleneck.
- Freight traffic flows [ton-km per year]. The freight transport flows are expressed in ton-km per year.
- Required contribution from the TEN-T budget in the period 2007-2013. This contribution is calculated using data from the report "Trans-European transport Network: TEN-T priority axes and project 2005". The remaining investments for the TEN-T project as of the end of 2004 (total costs – investments) are divided (linear) over the remaining project years. This makes it possible to determine the project budget in the period 2007-2013. Next, based on the co-financing rate, the required contribution from the TEN-T budget can be determined.

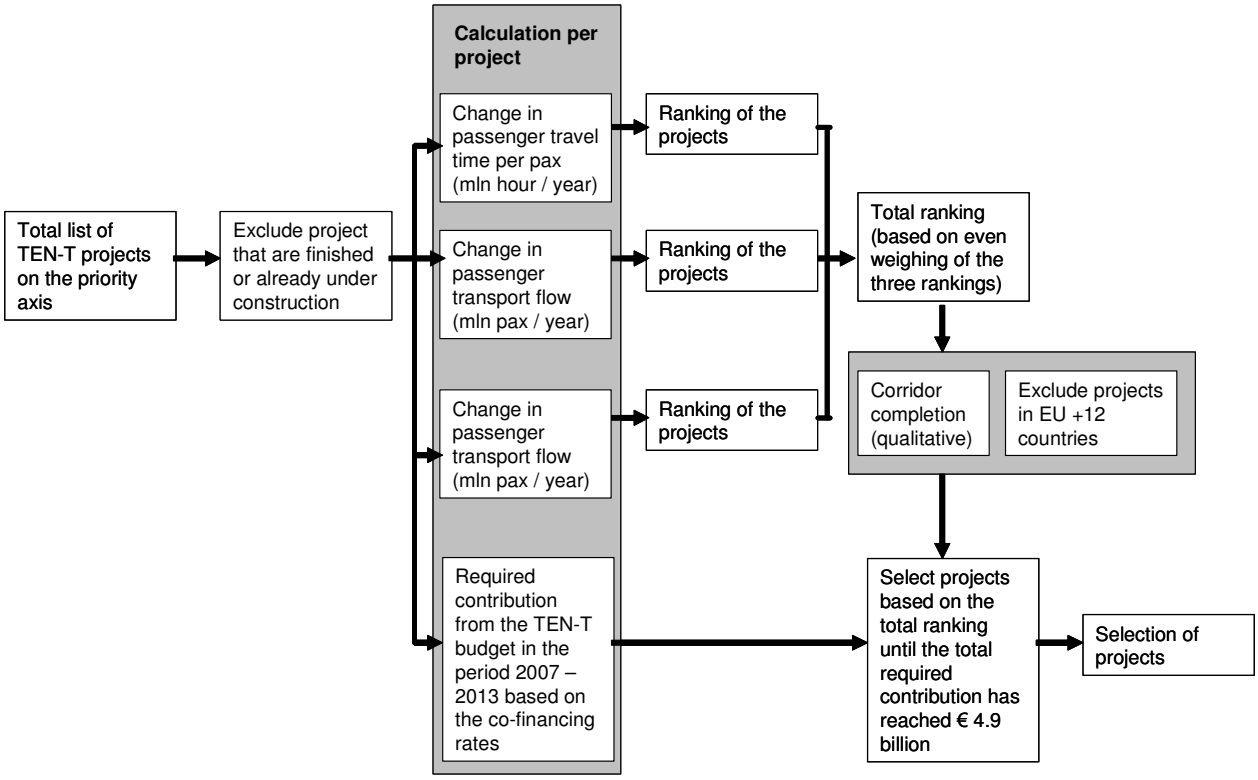
The projects are ranked based on the values on the first three indicators: 1 = best value, 2 = second best, etc. Then, a Multi Criteria Analysis is carried out, based on even weighing of the rankings on the three indicators. The result is an overall score for each of the projects.

It is noted that these criteria do not reflect the element of completing a corridor well enough since all sections are assessed separately. Clearly, there is a need to assess sections together as well, meaning that two sections that complement a corridor should be scored higher compared to one single section.

Therefore, a second step in the selection has been introduced. Each tentatively selected project was judged on whether it was part of a corridor or rather a "stand-alone" section. In case a project was stand alone (e.g. the Dax-Bordeaux rail line) the connecting sections were added (Bordeaux-Tours and Irun/Hendaye-Dax). This was done for most stand-alone sections, however for some it appeared that the connecting sections scored very low on the initial ranking. It that case it was decided to delete that project (e.g. the Messina bridge initially scored rather high mainly because of high traffic forecasts, but the connection section Napels-Messina scored very low, and therefore the Messina bridge was deleted).

The next step is to select the projects to include in this policy option. First the project with the overall best score is selected, followed by the project with the second highest score. This process is continued until the total required contribution from the TEN-T budget for the selected projects has reached approximately € 4.9 billion. The exact budget of the projects could be a bit more or less, depending on the last project to be selected. In case the budget used is for instance € 4.4 billion and the next project to be selected amount for € 0.8 billion, this project is selected leading to an overall budget of € 5.2 billion.

For reasons explained in chapter five projects in EU+12 countries are excluded from selection.



This selection process results in the following projects for policy option 1. The table also presents the values and ranking of these projects on the abovementioned indicators and the overall score.

Table A3.1 Selected projects in **minimum** scenario Policy Option 1 "Corridor concept"

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year)		Passenger traffic flows (mln pax/year)		Freight traffic flow (mln tonkm per year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Salzburg - Vöcklabruck	17	Rail	1.49	17	7.10	15	6,622	5	37	165
Prague - Nuremberg	22	Rail	1.83	15	2.90	31	7,663	1	47	311
Dax - Bordeaux	3	Rail	1.87	13	5.00	21	3,510	13	47	131
Lyon - Torino	6	Rail	2.15	12	5.72	19	2,805	17	48	1,945
Milan - Padova	6	Rail	1.27	20	6.92	16	3,101	16	52	1,379
Munich - Salzburg	17	Rail	0.85	30	8.10	13	3,589	10	53	68
Rheidt - Antwerp	24	Rail	1.22	23	5.50	20	3,372	15	58	58
Baudrecourt – Strasbourg-Kehl	17	Rail	0.58	38	8.30	12	3,541	11	61	218
Irún/Hendaye - Dax	3	Rail	1.23	21	5.00	22	2,295	23	66	18
Bordeaux-Tours	3	Rail	0.51	39	7.10	14	2,475	20	73	488
Stuttgart – Ulm	17	Rail	0.37	46	12.50	5	1,425	32	83	209
TOTAL										4,989

The following additional projects can be co-financed in the maximum scenario:

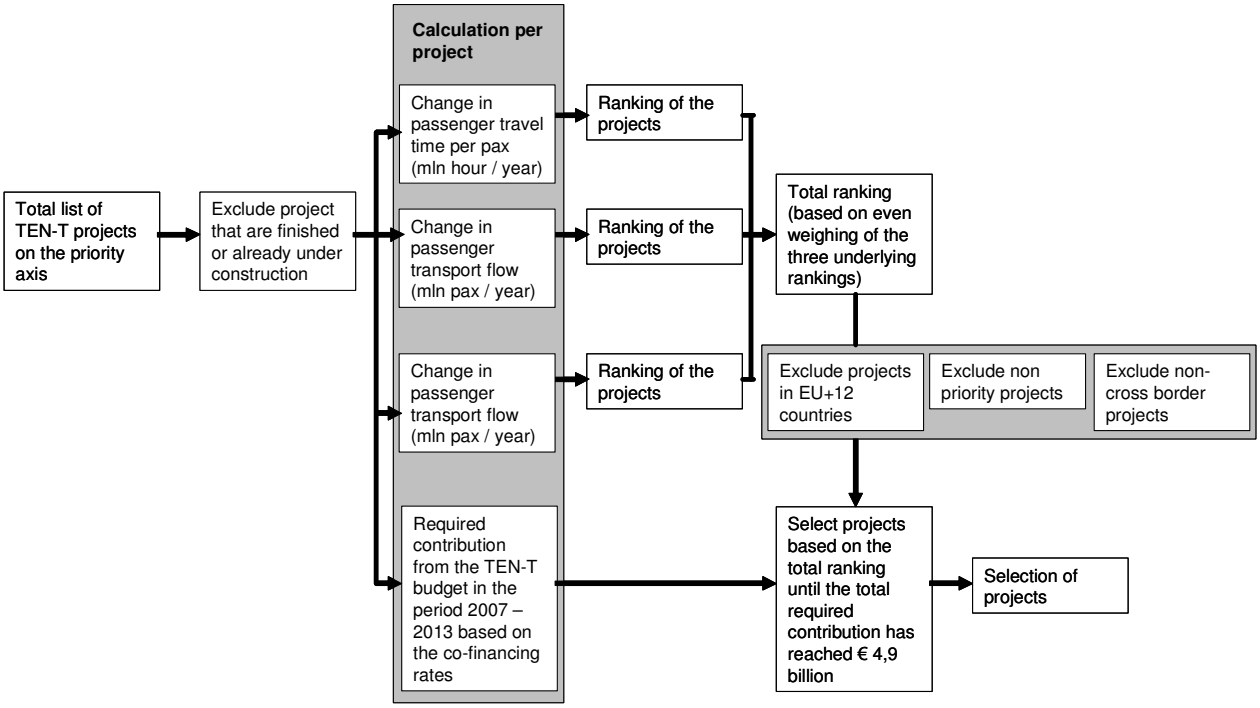
Table A3.2 Additional selected projects in **maximum** scenario Policy Option 1 "Corridor concept"

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year)		Passenger traffic flows (mln pax/year)		Freight traffic flow (mln tonkm per year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Venezia-Ronchi Sud –Triest - Divaca	6	Rail	3.15	8	1.33	43	2,698	18	69	581
Munich-Kufstein	1	Rail	0.77	34	9.10	10	1,715	28	72	113
Brussels - Luxembourg border	28	Rail	0.73	35	6.20	17	1,814	27	79	125
Lyon- Mulhouse - Müllheim	24	Rail	1.31	19	4.20	26	1,353	34	79	317
Puttgarden - Hamburg	20	Rail	0.45	43	10.20	8	1,571	30	81	82
Rodby - Puttgarden	20	Rail / Road	0.47	42	18.90	3	861	38	83	400
Perpignan - Montpellier	3	Rail	1.22	22	4.90	23	747	40	85	132
Hannover - Hamburg / Bremen	20	Rail	0.39	45	10.20	9	1,378	33	87	64
Brenner Tunnel	1	Rail	0.44	44	9.10	11	978	37	92	537
Montpellier – Nimes	3	Rail	0.70	37	4.90	24	427	43	104	136
Luxembourg – French border	28	Rail	0.07	50	6.20	18	186	47	115	13
TOTAL										5,011[77]

Option 2 "Cross-border focus"

In the policy option the same selection process as compared to the option 1 "corridor concept" is applied, based on the same indicators (i.e. travel time savings passengers, passenger traffic flows and freight traffic flows). However, in this option only priority sections are selected and only projects which are located on the territory of at least two Member States.

[77] Including a contribution of € 2428 for the project in the minimum scenario based on half of the co-financing rates.



Applying the above selection criteria results in the following projects for this policy option:

Table A3.3 Selected projects in **minimum** scenario Policy Option 2 – cross-border

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year)		Passenger traffic flows (mln pax/year)		Freight traffic flow (mln tonkm/ year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Lyon - Torino	6	Rail	2.15	12	5.72	19	2,805	17	48	1,945
Munich - Salzburg	17	Rail	0.85	30	8.10	13	3,589	10	53	68
Rheidt – Antwerp	24	Rail	1.22	23	5.50	20	3,372	15	58	58
Baudrecourt – Strasbourg-Kehl	17	Rail	0.58	38	8.30	12	3,541	11	61	218
Irún/Hendaye – Dax	3	Rail	1.23	21	5.00	22	2,295	23	66	18
Venezia-Ronchi Sud – Triest – Divaca	6	Rail	3.15	8	1.33	43	2,698	18	69	1,163
Munich-Kufstein	1	Rail	0.77	34	9.10	10	1,715	28	72	225
Lyon- Mulhouse - Müllheim	24	Rail	1.31	19	4.20	26	1,353	34	79	634
Rodby - Puttgarden	20	Rail / Road	0.47	42	18.90	3	861	38	83	800
TOTAL										5,128

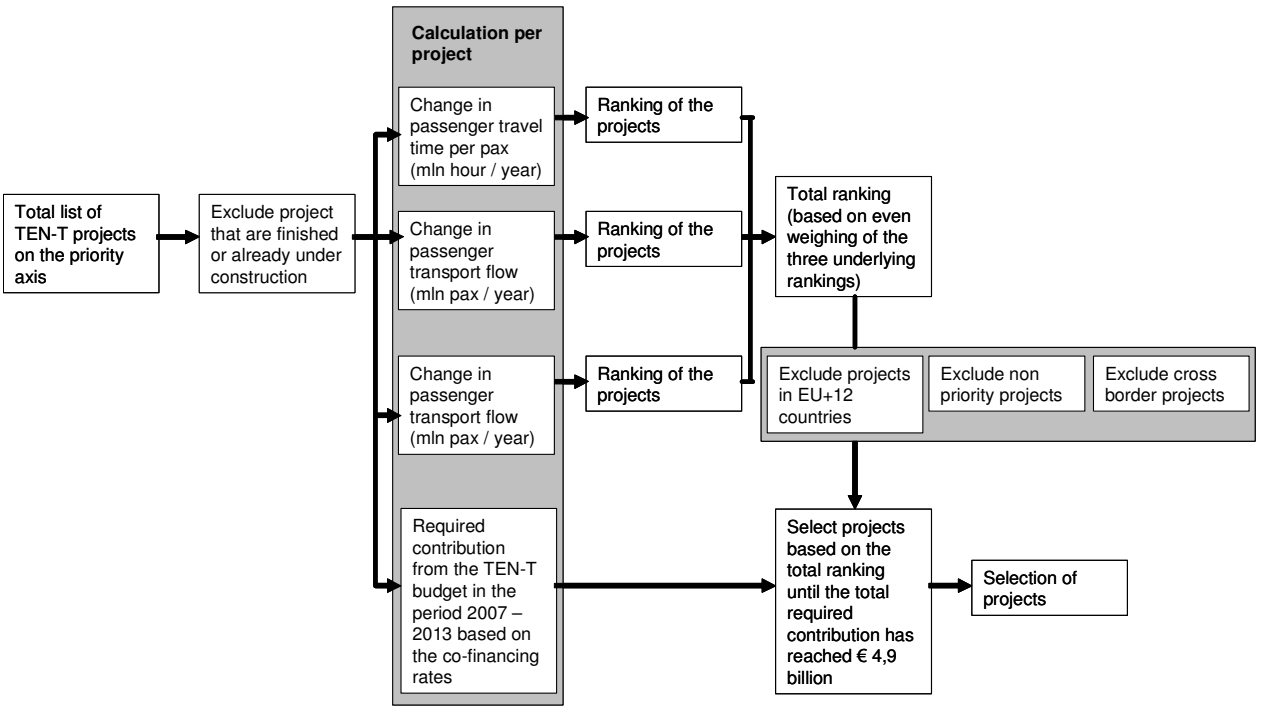
The following additional projects can be co-financed in the maximum scenario:

Table A3.4 Additional selected projects in **maximum** scenario Policy Option 2 – cross-border

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year)		Passenger traffic flows (mln pax/year)		Freight traffic flow (mln tonkm per year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Brenner Tunnel	1	Rail	0.44	44	9.10	11	978	37	92	537
Lisbon - Madrid	3	Rail	1.50	16	0.40	50	18	51	117	1,261
Sines - Badajoz	16	Rail	0.50	41	0.20	53	268	46	140	168
Aveiro-Salamanca	3	Rail	N.A.	53	0.50	49	149	48	150	578
Baudrecourt - Luxemburg	4	Rail	N.A.	53	N.A.	54	N.A.	54	161	73
Rhine - Meuse	18	Waterway	N.A.	53	N.A.	54	N.A.	54	161	26
Vienna-Bratislava	18	Waterway	N.A.	53	N.A.	54	N.A.	54	161	16
TOTAL										5,224[78]

Option 3 "Bottleneck focus"

In this policy option the same selection process as compared to the option 1 "corridor concept" is applied, based on the same criteria (i.e. travel time savings passengers, passenger traffic flows and freight traffic flows). However, in this option only priority sections of projects are selected and, contrary to option 2, only sections which are located on the territory of one Member State.



[78] Including a contribution of € 2665 for the project in the minimum scenario based on half of the co-financing rates.

Table A3.5 Selected projects in **minimum** scenario Policy Option 3 – bottlenecks

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year)		Passenger traffic flows (mln pax/year)		Freight traffic flow (mln tonkm per year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Dax - Bordeaux	3	Rail	1.87	13	5.00	21	3,510	13	47	131
Milan - Padova	6	Rail	1.27	20	6.92	16	3,101	16	52	1,379
Rail / road bridge Strait of Messina/Palermo	1	Rail	1.87	14	20.60	2	371	44	60	511
Lahti - Vainikkala	12	Rail	3.13	10	0.80	47	4,872	8	65	146
Bordeaux - Tours	3	Rail	0.51	39	7.70	14	2,475	20	73	488
Brussels - Luxembourg border	28	Rail	0.73	35	6.20	17	1,814	27	79	249
Puttgarden – Hamburg	20	Rail	0.45	43	10.20	8	1,571	30	81	164
Stuttgart – Ulm	17	Rail	0.37	46	12.50	5	1,425	32	83	209
Perpignan – Montpellier	3	Rail	1.22	22	4.90	23	747	40	85	264
Hannover - Hamburg/Bremen	20	Rail	0.39	45	10.20	9	1,378	33	87	128
Koskenilä– Vaalima	12	Road	0.21	48	10.70	7	665	42	97	70
Lisbon - Porto	3	Rail	0.02	51	4.60	25	2,307	22	98	428
Patras – Korinthos	7	Road	0.00	52	40.00	1	64	50	103	38
Montpellier – Nimes	3	Rail	0.70	37	4.90	24	427	43	104	271
Fuentes de Onora - Medina del Campo	8	Rail	0.86	29	1.40	42	979	36	107	24
Pontevedra - Viana do Castelo	8	Rail	0.80	33	2.00	37	339	45	115	61
Luxembourg - French border	28	Rail	0.07	50	6.20	18	186	37	115	26
Ioannina - Antirío - Río - Kalamata	29	Rail	1.47	18	0.30	51	12	52	121	146
Rodby - Oresund	20	Rail	0.33	47	1.50	40	684	41	128	81
Kozani-Kalambaka - Igoumenitsa	29	Rail	0.86	27	0.30	52	7	53	132	239
TOTAL										5,053

The following additional projects can be co-financed in the maximum scenario:

Table A3.6 Additional selected projects in **maximum** scenario Policy Option 3 – bottlenecks

Project/section	Axis	Mode	Travel time savings per pax (mln hours/year))		Passenger traffic flows (mln pax/ year)		Freight traffic flow (mln tonkm/year)		Overall score	Contribution from TEN-T (2007 – 2013)
			Hours	Rank	Pax	Rank	Tonkm	Rank		
Algeciras - Bobadilla	16	Rail	N.A.	53	N.A.	54	N.A.	54	161	29
Straubing - Vilshofen	18	Waterway	N.A.	53	N.A.	54	N.A.	54	161	11
Palkovicovo - Mohács	18	Waterway	N.A.	53	N.A.	54	N.A.	54	161	22
Cambrai - Compiègne	30	Waterway	N.A.	53	N.A.	54	N.A.	54	161	130
TOTAL										2,764[79]

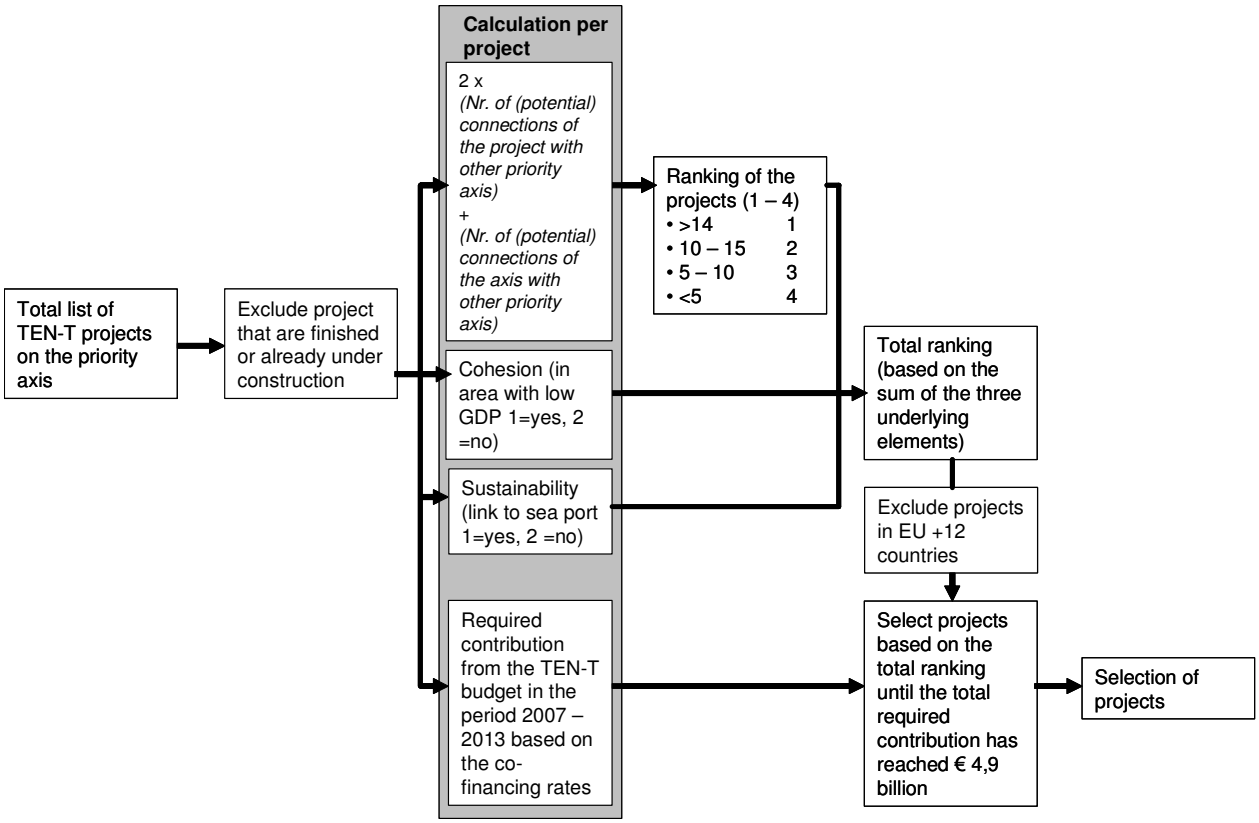
Option 4 "European Added Value"

The selection procedure for this policy option is based on the same methodology. However, compared to the previous policy options, a different set of indicators is used:

- Network effects [number of potential connections of the project with other priority axes and of the axe with other priority axes]. The number of (potential) connections of the project is thereby considered to be twice as important as the number of (potential) connections of the axe. Based on the total number of connections a rank from 1 to 4 is awarded to the project. This ranking is explained in the figure below.
- Sustainability. The sustainability is directly related to promoting intermodal transport. If the project is linked to a seaport a score of 1 is awarded, if not 2.
- Social cohesion [location within poorer region in EU]. If the project contributes to cohesion a score of 1 is awarded, if not the score is 2.

The overall score of the projects is determined by summing the scores on these three criteria. Projects with the lowest overall score are considered to have the highest European Added Value.

[79] Including a contribution of € 2302 for the project in the minimum scenario based on half of the co-financing rates.



Applying the above selection criteria results in the following projects for policy option 4:

Table A3.7 Selected projects in **minimum** scenario Policy Option 4 – high European added value

Project/section	*Axis*	*Mode*	*Nr. of connections of the project with other priority axis*	*Nr. of connections of the axis with other priority*	Rank network conditions	Cohesion (in area with low GDP 1=yes, 2 =no)	Sustainability (link to sea port 1=yes, 2 =no)	Overall score	Contribution from the TEN-T budget
Lisbon - Madrid	3	Rail	3	8	2	1	1	4	1,261
Lisbon - Porto	3	Rail	2	8	2	1	1	4	428
Rheidt - Antwerp	24	Rail	3	10	1	2	1	4	58
Rail / road bridge over the Strait of Messina - Palermo	1	Rail	0	5	3	1	1	5	511
Madrid - Levante and Mediterranean	19	Rail	2	3	3	1	1	5	399
Aveiro - Salamanca	3	Rail	2	8	2	1	2	5	578
Napels - Messina	1	Rail	0	5	3	1	1	5	451
Prague - Nuremberg	22	Rail	2	7	2	1	2	5	311
Prague - Linz	22	Rail	2	7	2	1	2	5	72
Sines - Badajoz	16	Rail	3	3	3	1	1	5	168
North-east corridor	19	Rail	2	3	3	1	1	5	108
Algeciras - Bobadilla	16	Rail	1	3	3	1	1	5	58
Vienna - Bratislava	18	Waterway	4	9	1	2	2	5	32
Vienna - Bratislava	17	Rail	4	10	1	2	2	5	21
Baudrecourt – Strasbourg-Kehl	17	Rail	2	10	2	2	2	6	218
Rhine - Meuse	18	Waterway	2	9	2	2	2	6	51
Köln-Rheidt and Köln-Duisburg	24	Rail	2	10	2	2	2	6	61
Irún/Hendaye - Dax	3	Rail	2	8	2	2	2	6	18
									4,905

The following additional projects can be co-financed in the maximum scenario:

Table A3.8 Additional selected projects in **maximum** scenario Policy Option 4 – high European added value

Project/section	*Axis*	*Mode*	*Nr. of (potential) connections of the project with other priority axis*	*Nr. of (potential) connections of the axis with other priority axis*	Rank network conditions	Cohesion (in area with low GDP 1=yes, 2 =no)	Sustainability (link to sea port 1=yes, 2 =no)	Overall score	Contribution from the TEN-T budget
Dax - Bordeaux	3	Rail	0	8	3	2	1	6	65
Bordeaux - Tours	3	Rail	0	8	3	2	1	6	244
Lyon - Torino	6	Rail	2	6	2	2	2	6	972
Milan - Padova	6	Rail	2	6	2	2	2	6	690
Munich - Salzburg	17	Rail	1	10	2	2	2	6	34
Stuttgart - Ulm	17	Rail	0	10	2	2	2	6	104
Salzburg - Vöcklabruck	17	Rail	0	10	2	2	2	6	83
Lyon - Mulhouse - Müllheim	24	Rail	1	10	2	2	2	6	317
									4,970[80]

[80] Including a contribution of € 2360 for the project in the minimum scenario based on half of the co-financing rates.

Annex 3: The SASI model

The SASI model is a recursive simulation model of socio-economic development of regions in Europe subject to exogenous assumptions about the economic and demographic development of the European Union as a whole and transport infrastructure investments and transport system improvements, in particular of the trans-European transport networks (TEN-T).

The SASI model was developed in the EUNET/SASI project (1996-2000) and applied in the IASON project (2001-2003) and in the ESPON projects 2.1.1 (2002-2004), 1.1.3 (2003-2005) and in the STEPs (2004-2006) and SETI (2005-2006) projects. In recent applications the model was extended to forecast not only distributional but also generative effects of transport infrastructure investments and was updated to use the most recent (2003) system of NUTS-3 regions and include the Western Balkan states.

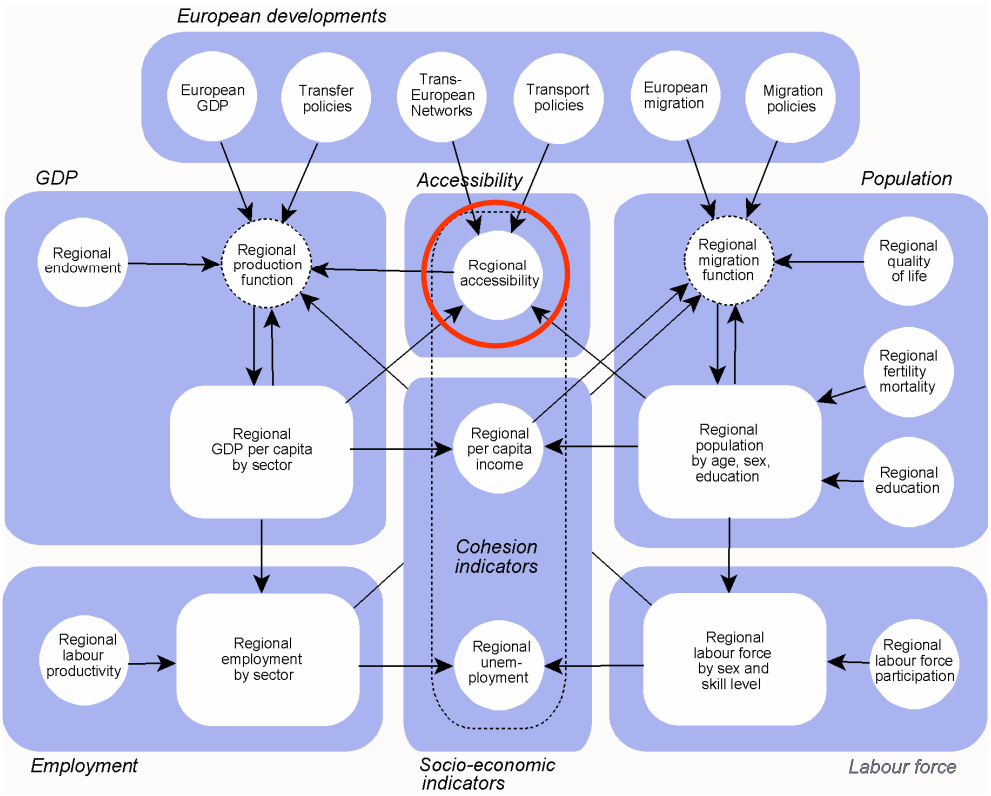
The SASI model differs from other approaches to model the impacts of transport on regional development by modelling not only production (the demand side of regional labour markets) but also population (the supply side of regional labour markets), which makes it possible to model regional unemployment. A second distinct feature is its dynamic network database maintained by RRG Spatial Planning and Geoinformation based on a 'strategic' subset of highly detailed pan-European road, rail and air networks including major historical network changes as far back as 1981 and forecasting expected network changes according to the most recent EU documents on the future evolution of the trans-European transport networks.

The *spatial* dimension of the model is established by the subdivision of the European Union, Norway and Switzerland and the Western Balkan countries in 1,330 regions and by connecting these by road, rail and air networks. For each region the model forecasts the development of accessibility and GDP per capita. In addition cohesion indicators expressing the impact of transport infrastructure investments and transport system improvements on the convergence (or divergence) of socio-economic development in the regions of the European Union are calculated.

The *temporal* dimension of the model is established by dividing time into periods of one year duration. By modelling relatively short time periods both short- and long-term lagged impacts can be taken into account. In each simulation year the seven submodels of the SASI model are processed in a recursive way, i.e. sequentially one after another. This implies that within one simulation period no equilibrium between model variables is established; in other words, all endogenous effects in the model are lagged by one or more years.

Figure A6.1 visualises the structure of the SASI model.

Figure A6.1. The structure of the SASI model



The SASI model has six forecasting submodels: *European Developments*, *Regional Accessibility*, *Regional GDP*, *Regional Employment*, *Regional Population* and *Regional Labour Force*. A seventh submodel calculates *Socio-Economic Indicators* with respect to efficiency and equity. The seven submodels are described below.

European Developments

The *European Developments* submodel is not a 'submodel' in the narrow sense because it simply prepares exogenous assumptions about the wider economic and policy framework of the simulations and makes sure that external developments and trends are considered.

For each simulation period the simulation model requires the following assumptions about European developments:

(1) *Assumptions about the performance of the European economy as a whole*. The performance of the European economy is represented by observed values of sectoral GDP for the study area as a whole for past years and forecasts for the future years until 2031. All GDP values are entered in Euro of 2006.

(2) *Assumptions about net migration across Europe's borders*. European migration trends are represented by observed annual net migration of the study area as a whole for past years and forecasts for future years until 2031.

These two groups of assumptions serve as constraints to ensure that the regional forecasts of economic development and population remain consistent with external developments not modelled in the Reference Scenario. To keep the total economic development exogenous in all scenarios would mean that the model would be prevented from making forecasts about the general increase in production through transport infrastructure investments (generative effects). However, its parameters are estimated in a way that makes it capable of doing that. Therefore the constraints are only applied to the Reference Scenario; by applying the adjustment factors of the Reference Scenario also to the policy scenarios, the changes in generative effects induced by the policies are forecast.

(3) *Assumptions about transfer payments by the European Union via the Structural Funds and the Common Agricultural Policy or by national governments to support specific regions.* European and national transfer payments are taken into account by annual transfers (in Euro of 2006) received by the regions in the European Union during the past and forecasts for future years until 2031.

(4) *Assumptions about European integration*. The accessibility measures used in the SASI model take account of existing barriers between countries, such as border waiting times and political, cultural and language barriers. These barriers are estimated for past years since 1981 and forecast for future years until 2031 taking into account the expected effects of further European integration.

(5) *Assumptions about the development of trans-European transport networks (TEN-T).* The European road, rail and air networks are backcast for the period between 1981 and 2006 in five-year increments and forecast in five-year increments until 2031. A *policy scenario* is a time-sequenced programme for addition or upgrading of links of the trans-European road, rail and air networks or other transport policies, such as different regimes of social marginal cost pricing.

The data for these assumptions do not need to be provided for each year nor for time intervals of equal length as the model performs the required interpolations for the years in between.

Regional Accessibility

This submodel calculates regional accessibility indicators expressing the locational advantage of each region with respect to relevant destinations in the region and in other regions as a function of the generalised travel cost needed to reach these destinations by the strategic road, rail and air networks.

For the selection of accessibility indicators to be used in the model three, possibly conflicting, objectives were considered to be relevant: First, the accessibility indicators should contribute as much as possible to explaining regional economic development. Second, the accessibility indicators should be meaningful by itself as indicators of regional quality of life. Third, the accessibility indicators should be consistent with theories and empirical knowledge about human spatial perception and behaviour.

In the light of these objectives potential accessibility, i.e. the total of destination activities, here population, $W_s(t)$, in 1,321 internal and 50 external destination regions s in year t weighted by a negative exponential function of generalised transport cost $c_{rsm}(t)$ between origin region r and destination region s by mode m in year t was adopted:

$$A_{rm}(t) = \sum_s W_s(t) \exp[-\beta c_{rsm}(t)] \quad (1)$$

where $A_{rm}(t)$ is the accessibility of region r by mode m in year t.

Modal generalised transport cost $c_{rsm}(t)$ consist of vehicle operating costs or ticket costs based on cost functions of the SCENES project and costs reflecting value of time. For the latter rail timetable travel times and road travel times calculated from road-type specific travel speeds are used and converted to cost by assumptions about the value of time of travellers and drivers. Only one common value of time is assumed for the whole study area, i.e. no distinction is made between the different wage levels and purchasing powers of countries. The border waiting times mentioned above are converted to monetary cost equivalents. In addition, political, cultural and language barriers are taken into account of as cost penalties added to the transport costs:

$$c_{rsm} = c'_{rsm}(t) + e_{r's'}(t) + s_{r's'} + \ell_{r's'} \quad \text{with } r \in \mathbf{R}_{r'} \quad (2)$$

in which $c'_{rsm}(t)$ is the travel cost between region r and region s in year t and $e_{r's}(t)$, $s_{r's'}$ and $\ell_{r's'}$ are exogenous time penalties for political, cultural and language diversity in year t between the countries $\boldsymbol{R}_{r'}$ to which regions r and s belong:

- $e_{r's'}(t)$ is a *European integration factor* reflecting in which supranational structures the two countries are, i.e. which political and economic relationship existed between them in year t,
- $s_{k'j'}$ is a *cultural similarity factor* reflecting how similar are cultural and historical experience of the two countries.
- $\ell_{r's'}$ is a *language factor* describing the grade of similarity of the mother language(s) spoken in the two countries

While the latter two factors are kept constant over the whole simulation, $e_{k'j'}(t)$ is reduced from year to year to account for the effect of European integration. The accessibility indicators used in the model are not standardised to the European average to show increases in accessibility over time.

Modal accessibility indicators are aggregated to one multimodal accessibility indicator expressing the combined effect of alternative modes by replacing the impedance term $c_{rsm}(t)$ by the composite or *logsum* impedance:

$$c_{rs}(t) = -\frac{1}{\lambda} \ln \sum_{m \in \mathbf{M}_{rs}} \exp[-\lambda c_{rsm}(t)] \quad (3)$$

where $\boldsymbol{M}_{rs}$ is the set of modes available between regions r and s. Four composite accessibility indicators are used: accessibility by rail and road for travel, accessibility by rail, road and air for travel, accessibility by road for freight and accessibility by rail and road for freight.

Regional GDP

The GDP submodel is based on a quasi-production function incorporating accessibility as additional production factor. The economic output of a region is forecast separately for the six economic sectors agriculture, manufacturing, construction, trade/transport/tourism, financial services and other services in order to take different requirements for production by each sector into account. The regional production function predicts annual regional GDP per capita:

$$q_{ir}(t) = \mathrm{f}\left[\mathbf{C}_{ir}(t), \mathbf{L}_{ir}(t), \mathbf{A}_{ir}(t), \mathbf{X}_{ir}(t), \mathbf{S}_{r}(t), R_{ir}(t)\right] \tag{4}$$

where q_{ir}(t) is annual GDP per capita of industrial sector i in region r in year t, $\boldsymbol{C}_{ir}(t)$ *is* a vector of capital factors relevant for industrial sector i in region r in year t, $\mathbf{L}_{ir}(t)$ is a vector of indicators of labour availability relevant for industrial sector i in region r in year t, $\mathbf{A}_{ir}$ is a vector of accessibility indicators relevant for industrial sector i in region r in year t, $\mathbf{X}_{ir}(t)$ is a vector of endowment factors relevant for industrial sector i in region r in year t, $\mathbf{S}_{r}(t)$ are annual transfers received by the region r in year t and R_{ir}(t) is a region-specific residual taking account of factors not modelled (see below). Note that, even though annual GDP is in fact a flow variable relating to a particular year, it is modelled like a stock variable.

Assuming that the different production factors can be substituted by each other only to a certain degree, a multiplicative function which reflects a limitation relation between the factors was chosen. Since this kind of function introduces the coefficients as exponents of the explaining variables it is possible to interpret the coefficients as elasticities of production reflecting the importance of the different production factors for economic growth in a sector. The operational specification of the regional production functions used in the SASI model is:

$$\begin{aligned} q_{ir}(t) = {} & C_{ir}(t-5)^{\alpha} \; L_{ir}(t-1)^{\beta} \; A_{ir}(t-1)^{\gamma} \; \ldots \; X_{ir}(t-1)^{\delta} \; \ldots \\ & S_{r}(t-1)^{\varepsilon} \; \exp(\rho) \; R_{ir}(t) \end{aligned} \tag{5}$$

where $q_{ir}(t)$ is GDP per capita of sector i in region r in year t, $C_{ir}(t–5)$ is the economic structure (share of regional GDP of sector i) in region r in year $t–5$, $L_{ir}(t–1)$ is a labour market potential indicating the availability of qualified labour in region r and adjacent regions, $A_{ir}(t–1)$ is accessibility of region r relevant for sector i in year $t–1$, $X_{ir}(t–1)$ is an endowment factor relevant for sector i in region r in year $t–1$, $S_{r}(t–1)$ are transfer payments received by region r in year $t–1$, $R_{ir}(t)$ is the regression residual of the estimated GDP values of sector i in region r in year t and α, β, χ, δ, ε and ρ are regression coefficients.

The ... indicate that depending on the regression results multiple accessibility indicators and endowment indicators can be included in the equation. The economic structure variable is used as an explanatory variable because the conditions for production in a certain sector depend on the given sectoral structure, which reflects historic developments and path dependencies not covered by other indicators in the equation. The economic structure variables is delayed by five years as structural change is a slow process. Endowment factors are indicators measuring the suitability of the region for economic activity. They include traditional location factors such as capital stock (i.e. production facilities) and intraregional transport infrastructure as well as 'soft' quality-of-life factors such as indicators describing the spatial organisation of the region, i.e. its settlement structure and internal transport system, or institutions of higher education, cultural facilities, good housing and a pleasant climate and environment. In addition, monetary transfers to regions by the European Union such as assistance by the Structural or Cohesion Funds or the Common Agricultural Policy or by national governments are considered, as these may account for a sizeable portion of the economic development of peripheral regions. Regional transfers per capita $S_r(t)$ are provided by the *European Developments* submodel (see above).

To take account of 'soft' factors not captured by the endowment and accessibility indicators of the model, all GDP per capita forecasts are multiplied by a region- and sector-specific residual constant R_{ir}. In the period 1981 to 2001, R_{ir} is the ratio between observed and predicted GDP per capita of sector i in region r in each year; hence in this period observed sectoral regional GDP is exactly reproduced by the model. In the period 2002 to 2031, the last residuals calculated for the year 2001 are applied.

In addition, the results of the regional GDP per capita forecasts are adjusted such that the total of all regional GDP meets the exogenous forecast of economic development (GDP) of the study area as a whole by the *European Developments* submodel (see above). However, these constraints are applied only to the reference scenario; in the policy scenarios the adjustment factors calculated for the reference scenario in each forecasting year are applied. In this way, the changes in generative effects induced by the policies are forecast.

Regional GDP by industrial sector $Q_{ir}(t)$ is then

$$Q_{ir}(t) = q_{ir}(t)\, P_r(t) \tag{6}$$

where $P_r(t)$ is regional population (see below).

Regional Employment

Regional employment by industrial sector is derived from regional GDP by industrial sector and regional labour productivity.

Regional labour productivity is forecast in the SASI model exogenously based on exogenous forecasts of labour productivity in each country:

$$p_{ir}(t) = p_{ir}(t-1)\,\frac{p_{ir'}(t)}{p_{ir'}(t-1)} \qquad \text{with } r \in \mathbf{R}_{r'} \tag{7}$$

where $p_{ir}(t)$ is labour productivity, i.e. annual GDP per worker, of industrial sector i in region r in year t, $p_{ir'}(t)$ is average labour productivity in sector i in year t in country or group of regions $\boldsymbol{R}_{r'}$ to which region r belongs. The rationale behind this specification is the assumption that labour productivity by economic sector in a region is predominantly determined by historical conditions in the region, i.e. by its composition of industries and products, technologies and education and skill of labour and that it grows by an average sector-specific growth rate.

Regional employment by industrial sector is then

$$E_{ir}(t) = Q_{ir}(t) / p_{ir}(t) \tag{8}$$

where $E_{ir}(t)$ is employment in industrial sector i in region r in year t, $Q_{ir}(t)$ is the GDP of industrial sector i in region r in year t and $p_{ir}(t)$ is the annual GDP per worker of industrial sector i in region r in year t.

Regional Population

The *Regional Population* submodel forecasts regional population by five-year age groups and sex through natural change (fertility, mortality) and migration. Population forecasts are needed to represent the demand side of regional labour markets.

Changes of population due to births and deaths are modelled by a cohort-survival model subject to exogenous forecasts of regional fertility and mortality rates. To reduce data requirements, a simplified version of the cohort-survival population projection model with five-year age groups is applied. The method starts by calculating survivors for each age group and sex:

$$P'_{asr}(t) = P_{asr}(t-1)\ [1 - d_{asr'}(t-1,t)] \qquad \text{with } r \in \mathbf{R}_{r'} \tag{9}$$

where $P'_{asr}(t)$ are surviving persons of age group a and sex s in region r in year t, $P_{asr}(t-1)$ is population of age group a and sex s in year $t-1$ and $d_{asr'}(t-1,t)$ is the average annual death rate of age group a and sex s between years $t-1$ and t in country or group of regions $\mathbf{R}_{r'}$ to which region r belongs.

Next it is calculated how many persons change from one age group to the next through ageing employing a smoothing algorithm:

$$g_{asr}(t-1,t) = 0.12\ P'_{asr}(t) + 0.08\ P'_{a+1sr}(t) \qquad \text{for } a = 1, 19 \tag{10}$$

where $g_{asr}(t-1,t)$ is the number of persons of sex s changing from age group a to age group $a+1$ in region r. Surviving persons in year t are then

$$P_{asr}(t) = P'_{asr}(t) + g_{a-1sr}(t-1,t) - g_{asr}(t-1,t) \qquad \text{for } a = 2,19 \tag{11}$$

with special cases

$$P_{20sr}(t) = P'_{20sr}(t) + g_{19sr}(t-1,t) \tag{12}$$

$$P_{1sr}(t) = P'_{1sr}(t) + B_{sr}(t-1,t) - g_{1sr}(t-1,t) \tag{13}$$

where $B_{sr}(t-1,t)$ are births of sex s in region r between years $t-1$ and t:

$$B_{sr}(t-1,t) = \sum_{a=4}^{10} 0.5\,[P'_{a2r}(t) + P_{a2r}(t)]\;\; b_{asr'}(t-1,t)\;\; [1 - d_{0sr'}(t-1,t)] \tag{14}$$

with $r \in \mathbf{R}_{r'}$

where $b_{asr'}(t-1,t)$ are average number of births of sex s by women of child-bearing five-year age groups a, $a = 4,10$ (15 to 49 years of age) in country or group of regions $\boldsymbol{R}_{r'}$ to which region r belongs between years $t-1$ and t, and $d_{0sr'}(t-1,t)$ is the death rate during the first year of life of infants of sex s in country or group of regions $\boldsymbol{R}_{r'}$ to which region r belongs. The exogenous forecasts of death and birth rates in the above equations are national rates.

Migration within the European Union and immigration from non-EU countries is modelled in a simplified migration model as annual regional net migration as a function of regional indicators expressing the attractiveness of a region as a place of employment and a place to live to take into account both job-oriented migration and retirement migration:

$$m_r(t) = \alpha\left(\frac{q_r(t-3)}{\bar{q}(t-3)} - 1.5\right) + \beta\left(\frac{v_r(t-3)}{\bar{v}(t-3)} - 1.5\right) \tag{15}$$

The attractiveness of a region as a place of employment is expressed as the ratio of regional GDP per capita $q_r(t-3)$ and average European GDP per capita $\bar{q}_r(t-3)$. The attractiveness of a region as a place to live is expressed as the ratio of the regional quality of life $v_r(t-3)$ and average European quality of life $\bar{v}(t-3)$. Both indicators are lagged by three years to take account of delays in perception. The forecasts of regional net migration are adjusted to comply with total European net migration forecast by the *European Developments* submodel.

Regional educational attainment, i.e. the proportion of residents with higher education in region r, is forecast exogenously assuming that it grows as in the country or group of regions to which region r belongs:

$$h_r(t) = h_r(t-1)\; h_{r'}(t) / h_{r'}(t-1) \qquad \text{with } r \in \mathbf{R}_{r'} \tag{16}$$

where $h_r(t)$ is the proportion of residents with higher education in region r in year t, and $h_{r'}(t)$ is the average proportion of residents with higher education in country or group of regions $\boldsymbol{R}_{r'}$ to which region r belongs.

Regional Labour Force

The regional labour force is derived from regional population and regional labour force participation.

Regional labour force participation by sex is partly forecast exogenously and partly affected endogenously by changes in job availability or unemployment. It is assumed that labour force participation in a region is predominantly determined by historical conditions in the region, i.e. by cultural and religious traditions and education and that it grows by an average country-specific growth rate. However, it is also assumed that it is positively affected by availability of jobs (or negatively by unemployment):

$$\ell_{sr}(t) = \ell_{sr}(t-1)\ \ell_{sr'}(t) / \ell_{sr'}(t-1) - \varphi_s\ u_r(t-1) \qquad \text{with } r \in \mathbf{R}_{r'} \tag{17}$$

where $\ell_{sr}(t)$ is labour force participation, i.e. the proportion of economically active persons of sex s of regional population of sex s 15 years of age and older, in region r in year t, $\ell_{sr'}(t)$ is average labour participation of sex s in year t in country or group of regions $\boldsymbol{R}_{r'}$ to which region r belongs, $u_r(t-1)$ is unemployment in region r in the previous year $t-1$ (see below), and φ_s is a linear elasticity indicating how much the growth in labour productivity is accelerated or slowed down by regional unemployment. Because at the time of execution of the *Regional Labour Force* submodel regional unemployment in year t is not yet known, unemployment in the previous year $t-1$ is used. Regional labour force by sex s in region r, $L_{sr}(t)$, is then

$$L_{sr}(t) = P_{sr}(t)\ \ell_{sr}(t) \tag{18}$$

where $P_{sr}(t)$ is population of sex s 15 years of age and older in region r at time t and $\ell_{sr}(t)$ is the labour force participation rate of sex s in region r in year t.

Regional labour force is disaggregated by skill in proportion to educational attainment in the region calculated in the *Population* submodel (see above):

$$L_{sr1}(t) = h_r(t)\ L_{sr}(t) \tag{19}$$

with $L_{sr1}(t)$ being skilled labour and the remainder unskilled labour:

$$L_{sr2}(t) = L_{sr}(t) - L_{sr1}(t) \tag{20}$$

Cohesion Indicators

From regional accessibility and GDP per capita forecast by the model equity or cohesion indicators describing their distribution across regions are calculated. Cohesion indicators are macroanalytical indicators combining the indicators of individual regions into one measure of their spatial concentration. Changes in the cohesion indicators predicted by the model for future transport policies reveal whether these policies are likely to reduce or increase existing disparities in accessibility and GDP per capita between the regions.

Annex 4: Literature list

Implementation and Annual Reports

- Implementation Report 1998
- Implementation Report 1998 – 2001
- Annual Report Priority Project 27 (2006): "Rail Baltica"
- Annual Report Priority Project 17 (2006): "Eisenbahnachse Paris-Straßburg-Stuttgart-Wien-Bratislava"
- Annual Report Priority Project 3 (2006): "Axe ferroviaire à grande vitesse du sud-ouest de l'Europe"
- Annual Report Priority Project 1 (2006): "Berlin-Verona/Milan-Bologna-Naples-Messina-Palermo rail link"
- Annual Report Priority Project (2006): "ERTMS project"
- Annual Report Priority Project 6 (2006): "Lyon – Torino – Milano – Trieste – Ljubljana – Budapest"

Legislation

- Regarding 2236/95/EC on Community financial aid in the field of trans-European networks:
  - 2236/95/EC: "Council Regulation (EC) of 18 September 1995 laying down general rules for the granting of Community financial aid in the field of trans-European networks"
  - 1655/99/EC: "Regulation (EC) No 1655/1999 of the European Parliament and of the Council of 19 July 1999 amending Regulation (EC) No 2236/95 laying down general rules for the granting of Community financial aid in the field of trans-European networks"
  - 2654/01/EC: "Commission decision of 19-09-2001 establishing an Indicative Multi-annual Programme for the granting of Community financial aid to projects of common interest in the area of the trans-European transport network for the period 2001 – 2006. Having regard to the Treaty establishing the European Community and having regard to Council Regulation (EC) N° 2236/95 of 18 September 1995 laying down general rules for the granting of Community financial aid in the field of trans-European networks, as amended by Regulation (EC) N° 1655/1999 of the European Parliament and of the Council, and in particular Articles 5a(1) thereof.
  - 0807/04/EC: "Regulation of the European Parliament and of the Council of 21 April 2004 amending Council Regulation (EC) No 2236/95 laying down general rules for the granting of Community financial aid in the field of trans-European networks."
  - 0788/04/EC: "Regulation of the European Parliament and of the Council of 21April 2004 amending Council Regulation (EC) No 2236/95 and Regulations (EC) No 1655/2000, (EC) No 1382/2003 and (EC) No 2152/2003 with a view to

adapting the reference amounts to take account of the enlargement of the European Union."

- XXXX/04 (Com): Proposal for a Regulation of the European Parliament and of the Council laying down general rules for the granting of Community financial aid in the field of trans-European transport and energy networks and modifying Regulation (EC) n° 2236/95 of the Council
- 1159/05/EC: Regulation of the European Parliament and of the Council of 6 July 2005 amending Council Regulation (EC) No 2236/95 laying down general rules for the granting of Community financial aid in the field of trans-European networks
- 0154/04 (Com): Amended proposal for a regulation of the European Parliament and of the council laying down general rules for the granting of Community financial aid in the field of trans-European transport and energy networks and amending Council Regulation (EC) No 2236/95

- Regarding 1692/96/EC on Community guidelines for the development of the trans-European transport network:
  - 1692/96/EC: "Decision of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network"
  - 1692/96/EC: "Corrigendum to decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network"
  - 1346/01/EC: "Decision of the European Parliament and of the Council of 22 May 2001 amending Decision No 1692/96/EC as regards seaports, inland ports and intermodal terminals as well as project No 8 in Annex III
  - 1346/01/EC: "Corrigendum to Decision No 1346/2001/EC of the European Parliament and of the Council of 22 May 2001 amending Decision No 1692/96/EC as regards seaports, inland ports and intermodal terminals as well as project No 8 in Annex III (OJ L 185 of 6.7.2001)"
  - 0884/04/EC: "Decision of the European Parliament and of the Council of 29 April 2004 amending Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network"
  - 0884/04/EC: "Corrigendum to Decision No 884/2004/EC of the European Parliament and of the Council of 29 April 2004 amending Decision No 1692/96/EC on Community guidelines for the development of the trans-European transport network"

- Draft multi-annual work programme for grants in the field of the Trans-European Transport Network (TEN-T) for the period 2007-2013 (Commission Decision C(2007) 2158)

Research

- High Level Group 1
  - Slides: "2003 The trans-European transport network: guidelines and financial rules Proposals of the Commission"
  - Maps: "Recommended Priority Projects of the TEN-T", "Priority Projects adopted in 1996" and "TEN-T projects of European Interest"

- Memos:
  - "Priority projects for the trans-European transport network up to 2020 (2003)"
  - "The trans-European transport network: new guidelines and financial rules (2003)"
  - "Building the trans-European transport network: Innovative funding solutions and interoperability of electronic toll systems (2003)"
- Reports:
  - "Final Report of the High level group on the Trans-European Transport Network (2003)"
  - "Commission staff working paper extended impact assessment of the proposal amending the amended proposal for a decision amending Decision No 1692/96/EC on the trans-European transport network (2003)"

- High Level Group 2
  - Map: "Extensions of the trans-European transport axes"
  - Report: "Networks for peace and development. Extension of the major trans-European transport axes to the neighbouring countries and regions. Report from the High Level Group chaired by Loyola de Palacio (2005)"
- Report: "TEN - Invest. Transport Infrastructure Costs and Investments between 1996 and 2010 on the Trans-European Transport Network and its Connection to Neighbouring Regions, including an Inventory of the Technical Status of the Transport-European Transport Network for the Year 2000. (2003)"
- Report: "Pan-European Transport Corridors and Areas Status Report (2005)"
- Report: "Midterm/Final Evaluation of the Trans-European Network (TEN) Risk Capital Facility (2006)"
- Report: "Evaluation of the TEN-T Road Traffic Management Projects (2001)"
- Report: "EVAMONTEN-T. EVAluation and MONitoring of TEN-T (2003)"
- Report: "Assess. Assessment of the contribution of the TEN and other transport policy measures to the mid-term implementation of the White Paper on the European Transport Policy for 2010 (2005)".
- Report: "Cost-Benefit Assessment of the Externalisation of the Management of Community Financial Support to the TEN-T Networks (2005)"
- Report: "Additionality of the Trans-European Transport Network (TEN-T) – Strategic Policy Implications related to Programme Renewal based on a Subjective, Formative Approach to Programme Performance and Evaluation (1999)."
- Reports "TEN-STAC": "D1+ Description of the base year 2000 and interim forecasts 2020 (incl. Corrigendum)" and "Final Interception Report"
- Report: "Communication from the commission: A European initiative for growth investing in networks and knowledge for growth and jobs. Final Report to the European Council (2003)"
- INTERMODA: Integrated solutions for intermodal transport between the EU and the CEEC's - Outlining the Methodology for Identifying and Prioritising Bottlenecks and Constraints, and the Use of the Methodology, INTERMODA-consortium (led by TINA, Austria), July 2003.
- FUNDING – Funding infrastructure: guidelines for Europe (consortium led by KU Leuven, Belgium)
  - Deliverable 1: Economics of European Infrastructure Funds – Methodology

    - Deliverable 2: Consortium funding scenarios for EU infrastructure fund and mark-ups
- Strategic Guidelines Cohesion Policy

Others

- TEN-T Brochure 2005
- TEN-T SUPPORTED Actions 2004
- TEN-T SUPPORTED Actions 1983-2004
- Slides: “Trans-European transport network (TEN) policy”