Ex post evaluation of cohesion policy interventions 2000-2006 financed by the Cohesion Fund – **Work Package B:**
Cost-benefit analysis of selected transport projects
SECOND INTERIM REPORT

18th March 2011
Cost-benefit analysis of selected transport projects

**Executive Summary**

1 Introduction 27

1.1 Objective................................................................................................................. 27

1.2 Wider impacts assessment ..................................................................................... 29

1.3 Structure ................................................................................................................ 30

2 High speed railway Madrid – Barcelona in Spain 33

2.1 Project characteristics .......................................................................................... 33

2.2 Ex post CBA........................................................................................................... 34

2.3 Ex ante CBA ......................................................................................................... 36

2.4 Comparison of ex ante and ex post CBA ............................................................ 38

3 A2 motorway in Poland 41

3.1 Project characteristics .......................................................................................... 41

3.2 Ex post CBA........................................................................................................... 41

3.3 Ex ante CBA ......................................................................................................... 44

3.4 Comparison of ex ante and ex post CBA ............................................................ 47

4 Algarve railway in Portugal 49

4.1 Project characteristics .......................................................................................... 49

4.2 Ex post CBA........................................................................................................... 49

4.3 Ex ante CBA ......................................................................................................... 52

4.4 Comparison of ex ante and ex post CBA ............................................................ 54

5 A23 motorway in Spain 57

5.1 Project characteristics .......................................................................................... 57

5.2 Ex post CBA........................................................................................................... 57

5.3 Ex ante CBA ......................................................................................................... 60

5.4 Comparison of ex ante and ex post CBA ............................................................ 62

6 Agiou Konstantinou bypass in Greece 63

Contents
6.1 Project characteristics ................................................................. 63
6.2 Ex post CBA ................................................................................. 63
6.3 Ex ante CBA ................................................................................ 67
6.4 Comparison of ex ante and ex post CBA .................................... 69
7 M1 northern motorway in Ireland ............................................... 71
  7.1 Project characteristics ................................................................. 71
  7.2 Ex post CBA ................................................................................ 71
  7.3 Ex ante CBA ................................................................................ 74
  7.4 Comparison of ex ante and ex post CBA ................................. 76
8 Railway Thriassio-Pedio-Eleusina-Korinthos in Greece ...................... 79
  8.1 Project characteristics ................................................................. 79
  8.2 Ex post CBA ................................................................................ 79
  8.3 Ex ante CBA ................................................................................ 82
  8.4 Comparison of ex ante and ex post CBA .................................... 84
9 IX B corridor in Lithuania ................................................................. 87
  9.1 Project characteristics ................................................................. 87
  9.2 Ex post CBA ................................................................................ 87
  9.3 Ex ante CBA ................................................................................ 90
  9.4 Comparison of ex ante and ex post CBA ................................. 92
10 Bratislava Rača – Trnava Railway Upgrade in Slovakia ...................... 95
  10.1 Project characteristics ................................................................. 95
  10.2 Ex post CBA ................................................................................ 95
  10.3 Ex ante CBA ................................................................................ 98
  10.4 Comparison of ex ante and ex post CBA ................................. 100
11 M0 Budapest Ring Road (eastern section) in Hungary ...................... 103
  11.1 Project characteristics ................................................................. 103
  11.2 Ex post CBA ................................................................................ 103
  11.3 Ex ante CBA ................................................................................ 107
11.4  Comparison of ex ante and ex post CBA .............................. 108

12  Conclusions  .......................................................... 111

12.1  Preliminary observations .............................................. 111

Annexe 1: The ‘Rule of Half’  ............................................. 113

Annexe 2: Semi-structured stakeholders interview  ....................... 115

Appendices 1 to 10: Detailed case studies
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADT</td>
<td>Average Annual Daily Traffic</td>
</tr>
<tr>
<td>ADIF</td>
<td>Administrador de Infraestructuras Ferroviarias. The railway infrastructure manager in Spain</td>
</tr>
<tr>
<td>AHVV</td>
<td>Average Hourly Value of time for one Vehicle</td>
</tr>
<tr>
<td>AVE</td>
<td>Spanish high-speed railway service (Alta Velocidad Española)</td>
</tr>
<tr>
<td>B/C ratio</td>
<td>Benefit cost ratio. Also BCR.</td>
</tr>
<tr>
<td>BIR</td>
<td>Benefit investment ratio</td>
</tr>
<tr>
<td>BOE</td>
<td>Spanish official state gazette (Boletín Oficial del Estado)</td>
</tr>
<tr>
<td>CBA</td>
<td>Cost Benefit analysis. Also COBA</td>
</tr>
<tr>
<td>CF</td>
<td>Cohesion Funds</td>
</tr>
<tr>
<td>CP</td>
<td>Comboios de Portugal. A state-owned company which operates freight and passenger trains in Portugal.</td>
</tr>
<tr>
<td>CSO</td>
<td>Irish Central Statistical Office</td>
</tr>
<tr>
<td>CUPT</td>
<td>Centre for EU Transport Projects. Body set up to implement programmes and projects of the transport infrastructure development, particularly programmes and projects co-financed by EU funds in the programming period of 2007 - 2013.</td>
</tr>
<tr>
<td>DIA</td>
<td>Environmental Impact Declaration (Declaración de Impacto Medioambiental)</td>
</tr>
<tr>
<td>DoF</td>
<td>Irish Department of Finance</td>
</tr>
<tr>
<td>EBRD</td>
<td>European Bank for Reconstruction and Development</td>
</tr>
<tr>
<td>EC</td>
<td>European Commission</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
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<tr>
<td>EIB</td>
<td>European Investment Bank.</td>
</tr>
<tr>
<td>EIRR</td>
<td>Economic internal rate of return.</td>
</tr>
<tr>
<td>ENPV</td>
<td>Economic net present value.</td>
</tr>
<tr>
<td>ERDF</td>
<td>European Regional Development Fund</td>
</tr>
<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
</tr>
<tr>
<td>FNPV(C)</td>
<td>Financial net present value of the investment.</td>
</tr>
<tr>
<td>FNPV(K)</td>
<td>Financial net present value of capital.</td>
</tr>
<tr>
<td>FRR</td>
<td>Financial rate of return.</td>
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<tr>
<td>FRR(C)</td>
<td>Financial rate of return of the investment.</td>
</tr>
<tr>
<td>FRR(K)</td>
<td>Financial rate of return of capital.</td>
</tr>
<tr>
<td>GDDKiA</td>
<td>Generalna Dyrekcja Drog Krajowych Autostrad (Polish General Directorate for National Roads and Highways). Established in the Polish Ministry of Transportation, GDDKiA is the authority in charge of managing the national roads and the implementation of the state budget in the sector.</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HEATCO</td>
<td>EC funded research project in charge of &quot;Developing Harmonised European Approaches for Transport Costing and Project Assessment&quot;.</td>
</tr>
<tr>
<td>HGV</td>
<td>Heavy goods vehicle.</td>
</tr>
<tr>
<td>INE</td>
<td>Spanish National Statistics Institute (Instituto Nacional de Estadística)</td>
</tr>
<tr>
<td>IRR</td>
<td>Internal rate of return.</td>
</tr>
<tr>
<td>ISPA</td>
<td>Instrument for Structural Policies for Pre – Accession</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>JASPERS</td>
<td>Joint Assistance to Support Projects in European Regions. A joint initiative of the EIB, EBRD and EC to assist the 12 Central and Eastern EU Member States in the preparation of major projects to be submitted for grant financing under the Structural and Cohesion Funds.</td>
</tr>
<tr>
<td>LAV</td>
<td>High-speed line (<em>Linea de Alta Velocidad</em>)</td>
</tr>
<tr>
<td>LGV</td>
<td>Light goods vehicle.</td>
</tr>
<tr>
<td>LRA</td>
<td>Lithuanian Road Administration</td>
</tr>
<tr>
<td>NDS</td>
<td>Slovakian highway authority (<em>Národná diaľničná spoločnosť</em>)</td>
</tr>
<tr>
<td>NRA</td>
<td>National Roads Authority</td>
</tr>
<tr>
<td>NTDP</td>
<td>Lithuanian National Transport Development Programme</td>
</tr>
<tr>
<td>OKA</td>
<td>Hungarian National Highway Databank</td>
</tr>
<tr>
<td>PATHE</td>
<td>Patras, Athens, Thessaloniki, Evzoni</td>
</tr>
<tr>
<td>PCU</td>
<td>Passenger Car Units</td>
</tr>
<tr>
<td>PIA</td>
<td>Personal Injury Accidents</td>
</tr>
<tr>
<td>PLN</td>
<td>Polish Zloty</td>
</tr>
<tr>
<td>PSV</td>
<td>Passenger Service Vehicle (i.e. bus or coach)</td>
</tr>
<tr>
<td>PTE</td>
<td>Portuguese Escudos</td>
</tr>
<tr>
<td>POVT</td>
<td>Programa Operacional Temático Valorização do Território. The Portuguese government programme for the implementation of infrastructure projects</td>
</tr>
<tr>
<td>PVB</td>
<td>Present Value Benefit</td>
</tr>
<tr>
<td>REFER</td>
<td>Rede Ferroviária Nacional. The railway infrastructure manager in Portugal</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>RSA</td>
<td>Irish Road Safety Association</td>
</tr>
<tr>
<td>SEZ</td>
<td>Special Economic Zone</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium size Enterprise</td>
</tr>
<tr>
<td>TEN-T</td>
<td>Trans European transport network</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms of Reference</td>
</tr>
<tr>
<td>VAT</td>
<td>Value Added Tax</td>
</tr>
<tr>
<td>VOC</td>
<td>Vehicle Operating Costs</td>
</tr>
<tr>
<td>VOT</td>
<td>Value of Time</td>
</tr>
<tr>
<td>ŽSR</td>
<td>Slovakian rail authority (Železnice Slovenskej Republiky)</td>
</tr>
<tr>
<td>ŽSSK</td>
<td>Železničná spoločnosť Slovensko. Slovak state-owned passenger train operating company</td>
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Executive Summary

Introduction

Frontier Economics, together with Atkins and the Institute of Transport Studies, University of Leeds, are pleased to present this Second Interim Report for the “Ex post evaluation of cohesion policy interventions 2000-2006 financed by the Cohesion Fund – Work Package B: Cost-benefit analysis of selected transport projects”.

Following the completion of the Project Descriptions report (the second deliverable for this study), DG REGIO selected the ten projects to be taken forward in this study, which completed Task 1 of this study. The objective of Task 2 is to carry out an in-depth ex post CBA for ten selected transport projects.

The Terms of Reference of the study require the full analysis to be completed first for two pilot projects, to test the methodology and refine it before the remainder of the analysis for the remaining eight projects is carried out. The two pilot projects that DG REGIO chose were:

- Pilot 1: Construction of the A2 motorway between Konin and Strykow, Poland
- Pilot 2: Modernisation of the Lisbon - Algarve railway, Portugal

The results of this analysis were presented in the First Interim Report at the end of last May. Following the submission of the report, we discussed how our methodology could be improved to better fulfil DG REGIO’s objective for this study taking account of the feedback from the Steering Group and the external experts.

The methodology we have used in this Second Interim Report is therefore an amended version of the approach we used for the Pilot case studies. In particular, we have modified our approach to:

- enhance the description of the socio-economic context for each project;
- presenting their strategic objectives; and,
- understanding the wider impacts attributable to each project, over and above those included in the core cost-benefit analysis.

This Second Interim Report provides the results of the ten ex post evaluations. The degree of completion of such evaluation differs across the set of projects. The main objective of this Report is to inform the subsequent discussion, both internal and at Steering Group level, regarding the findings and
recommendations of the study. We will address remaining information gaps, and a fuller set of findings and recommendations in the Final Report. For this reason, while we have provided some overall observations on the expected final results of the study in the conclusions section, we have not yet attempted to fully identify key unifying messages and themes emerging from the ex post evaluation exercise.

In the rest of this executive summary we present key summary information on:

- key features of each project;
- results of the ex post evaluations;
- key sources of benefits;
- wider economic impact;
- review of ex ante cost-benefit analysis;
- comparison of ex ante and ex post analysis;
- role of ex ante cost benefit analysis; and
- conclusions and next steps

### Summary of the key features of the projects

For each project we have analysed, we provide here a summary of its key features and objectives.

**High speed railway Madrid – Barcelona in Spain**

The LAV (Línea de Alta Velocidad) Madrid – Barcelona – French border is a high speed railway line connecting Madrid to the French border via Barcelona. At the moment of writing, only the section Madrid – Barcelona is operational. We have therefore focused the ex post analysis on this section rather than on the whole project. The segment between Barcelona and the French border is still under construction and it is expected to be operational in 2013.

The LAV is part of the TEN-T Priority Project 3 (high-speed railway axis of south-west Europe), whose main objective is to provide high-speed rail connections between the Iberian Peninsula (Portugal and Spain) and the rest of Europe.

As defined in the TORs, the project comprises 12 subprojects. These cover the construction of 72 km of rail bed and the installation of 610 km of railway tracks. The total cost of the 12 subprojects was around €1,719 million, of which €1,442 million was eligible for funding. The total Cohesion Fund contribution for these subprojects in the period 2000-2006 was around €1,042 million, equal to 72.25% of the eligible project costs. The overall capital investments for the LAV between
Madrid and Barcelona amount to €7,336 million, with total Cohesion Fund contributions around €3,389 million during the period 2000 – 2006.

The main objective of the LAV Madrid - Barcelona – French border is to enable rail connections between the Iberian Peninsula and the rest of Europe without the need for reloading, which is needed as a result of the historic gauge difference between the rail networks in Spain/Portugal and the rest of Europe. The new railway line between Madrid and Barcelona implies that the two biggest cities in Spain are now linked by train in two hours and half hours, creating an alternative to the busiest air corridor in the world.

**A2 motorway in Poland**

This project involved the construction of approximately 100km of new motorway between the towns of Konin and Strykow in central Poland. The route is of national and international importance and forms part of the European Route E30 between Berlin and Belarus. This section of the A2 is part of a wider package of projects to construct a high standard road transport link between Berlin and Warsaw, as well as improving connectivity at local and regional scale. The section between Strykow (at the eastern end of the project) and Warsaw is currently under construction.

The total aggregate cost of the project was €406.3m. The total amount eligible for EU funding was €401.4m. The total Cohesion Fund contribution in the period 2004-2006 was €325.2m for the entire project. This contribution covered 82% of the cost for the Konin-Emilia subsection and 75% of the costs for the Emilia-Strykow subsection. The EIB also contributed to this project, up to the maximum allowed level (90%).

Prior to the construction of the A2, the main connecting route between the major settlements in the area was the single lane R72 (linking Strykow and Lowicz) resulting in traffic congestion and poor journey time reliability and high risk of accidents. The main objectives of the A2 project were therefore to improve connectivity at local and regional level, thus reducing journey times, relieving traffic congestion, and improving safety.

**Algarve railway in Portugal**

This project covers the modernisation of the railway line between Coina (near Lisbon) to Faro (in the Algarve region) in Portugal, including the branch to Porto de Sines. The total extension of both rail segments is around 275 km and 50 km respectively. The project is part of the TEN-T Priority Project 8 (Multimodal Axis Portugal/Spain – Rest of Europe). The total aggregate cost for the 4 subprojects included in our study was €419m, with a total amount eligible for funding equal to €405m. The total Cohesion
Fund contribution during the period 2000-2006 was €323m equal to about 80% of the eligible project costs.

The increase in the maximum speed on the line to 220km/h, thanks to additional double track sections, the installation of a new automatic control system and the complete electrification of the line, allowed the reduction of the journey between Lisbon and Faro to around 3h.

The current ex post cost benefit analysis covers the segment between Pinhal Novo and Faro, including the branch to Porto de Sines. The 15 km rail segment between Coimbra and Pinhal Novo was not included in the ex ante analysis covering this project (it was included in another analysis focusing on the modernisation of the Lisbon interurban rail system), and we have decided to exclude it in order to allow a more precise ex ante / ex post comparison.

**A23 motorway in Spain**

This project covers the construction of 75 km of the A23 motorway in Spain, covering two separate segments, one of 63.5 km between Teruel and Calamocha and another of 11.5 km between Huesca and Nueno. The A23 (also called Autovía Mudéjar) is a high capacity road, long 440 km (370km in service), connecting Sagunto, on the Mediterranean coast north of Valencia, and the Somport road tunnel, which connects France and Spain through the central Pyrenees. The A23 partially belongs to the European route E07 connecting Pau (France) and Zaragoza (Spain).

The total aggregate cost for the 4 subprojects included in our study was €203m with a total amount eligible for funding equal to €198m. The total Cohesion Fund contribution during the period 2000-2006 was €168m, equal to about 85% of the eligible project costs.

The main objective of the A23 is to facilitate the freight traffic between the Levante (Eastern Spain) region and Aragón, in Spain, and France. The new road was designed to become the natural route through the central Pyrenees, adding capacity to the existing wide road connections between Spain and France in both extremes of the Pyrenees, Irun-Hendaya to the West and La Jonquera to the East.

**Agiou Konstantinou bypass in Greece**

This project involved the construction of a bypass around the town of Agios Konstantinos and an upgrade of an existing Bypass around Kamena Vourla, both in Greece. This is part of the PATHE (Patras-Athens-Thessaloniki-Evzoni) corridor. The route is of national importance because it links the two largest cities in Greece (Athens and Thessaloniki), internationally the route supports an important link between Greece, Central Europe, and the Balkans.
The total cost of the project was €317.8m (2000 prices, including VAT). 37% of the funding was from the Cohesion Fund and the remainder was financed by national funding.

The project was required because the road through Agios Konstantinos ran between the sea and the town; therefore little opportunity existed to undertake any online improvements to the existing road. The narrow cross section of the road did not allow safe overtaking opportunities and severe congestion events were commonplace particularly in the summer months. The main objectives of the project were to reduce journey times, increase capacity and improve safety.

M1 northern motorway in Ireland

This project covers the construction of two sections of the M1 motorway in Ireland. The first section runs from Cloghran to Lissenhall and the second section joins this road with the Balbriggan Bypass further north. The M1 Motorway is part of the TEN-T Priority Axis 13 (Ireland – United Kingdom – Benelux). The main objective of the investments in this corridor is the reduction in journey times between Ireland, the UK and mainland Europe.

The total aggregate cost for this project was €232m. The Cohesion Fund contributions (€152m) were used initially in the planning and pre-construction phases. This covered initial design, detailed design, site surveys and investigation, the Environmental Impact Assessment, a public consultation process and the preparation of contract documentation. For phase 2 cohesion fund contributions were used to for construction, including earthworks, pavement, drainage and fencing and the construction of nine bridges. Interchanges, side roads and land acquisition were financed by the Irish Government. The eligible cost for co-financing was €173m.

The construction of the new sections of the M1 were required to upgrade the heavily congested existing N1 road and was seen by the Irish Government as being key to meeting European, national, regional and local objectives. The main objectives of the construction of this motorway was to Improve transit times, safety levels and level of service and to provide essential infrastructure support for economic development (particularly industry and tourism) by improving access to Dublin’s port, airport and the main domestic markets.

Railway Thriassio – Pedio – Eleusina – Korinthos in Greece

The project covers a rail upgrade between Thriasio (north west of Athens) and Kiato in Greece. The new line has replaced a former single track metric line passing through a number of urban areas. The 112km section runs parallel to the European TEN-T network Motorway Priority Axis 7 (Igoumenista-Patras-Athens-Sofia-Budapest) and forms part of longer term proposals to upgrade the Piraeus-Athens-Patra line. The route is covered by four funding applications for cohesion funding. Three of the sub-projects are related to the section of track.
running from Thriasio to Korinthos. An additional funding application was made for the section of track between Korinthos and Kiato.

The total cost of the project was €508m. Of this, the total amount eligible for EC funding was €238m, 47% of the total spend.

The old line between Thriasio and Kiato had poor geometric features, an old infrastructure, different gauge from the rest of Greece, and a lack of modern telecommunications and signalling. The line also passed through a number of built up areas and contained a number of level crossings. As a result, although track speed was generally 90km/h it dropped to as low as 25km/h in places. The objectives of the improvement project were to reduce journey times, increase revenue and decrease operating costs, improve safety, improve connectivity with the wider network and provide employment during construction.

**IX B corridor in Lithuania**

This project covers the modernisation of one of the two main motorway routes in Lithuania. This is part of the IX B transport corridor, 315km of motorway linking the port city of Klaipeda with the capital city of Vilnius, via Kaunas. The route then links Lithuania with other destinations in Eastern Europe. The project also involved the construction of the Vilnius Southern bypass.

The modernisation of the IX B Corridor was required to prepare this motorway, a key element of the Lithuanian transport network, for higher and heavier volumes of commercial traffic expected in the coming years. The main objective for the construction of the Vilnius Southern bypass was to reduce chronic delays caused by transit and local traffic being forced through the historic district of the city.

The total aggregate cost for this project was €154m, while the total amount eligible for funding was €148m, or about 96 per cent of the total. The total ISPA/Cohesion Fund contribution was €121m, equal to about 82% of the eligible project costs.

**Bratislava Rača – Trnava Railway Upgrade in Slovakia**

This project covers a rail upgrade between Bratislava Rača and Trnava in Slovakia. The 39km section forms part of the Corridor Va TEN-T rail corridor which runs in Slovakia between Bratislava, Žilina and Košice, then onto the border with Ukraine. The section of line also forms part of Priority Axis No. 23. The modernization project includes two separate applications for funding, the first including the upgrade of the line between Bratislava Rača to Šenkvice (2000/SK/16/P/PT/001), and the second upgrading the line between Šenkvice and Cífer and all the stations along the section between Bratislava Rača and Trnava (2001/SK/16/P/PT/003).
The total cost for the two projects combined was €213m. Of this, the total amount eligible for funding was €163m or about 77% of the total spent. The total ISPA/Cohesion Fund contribution was €89m, equal to about 55% of the eligible project costs and 42% of the total costs.

The main aims of the project were to improve the speed, comfort and attractiveness of the railway, thus making it more competitive in the transport market. The modernized rail infrastructure would also improve safety and significantly reduce the operating and maintenance costs of the line, whilst meeting international standards (AGTC) of rail track and complying with EU interoperability requirements.

**M0 Budapest Ring Road (eastern section) in Hungary**

The M0 Eastern Sector is the eastern component of the Budapest orbital motorway, whilst the M31 is a linking motorway between it and the M3 (the motorway to the north east of Hungary). The project has important international, national and local dimensions. Budapest sits on the junction of three land based Helsinki corridors, is the focus of the national transport network and is the economic centre and capital of Hungary. Congestion in the city centre, particularly in the vicinity of the Danube is severe. This project therefore performs an important function in facilitating the movement of international and national traffic while also providing some traffic relief to Budapest.

The total aggregate cost of the project was €370.5m of which €284.7m has been contributed by the EC. This contribution represents 85% of the eligible project costs.

There have been a number of technical challenges associated with the evaluation. The definition of the counterfactual has been extremely problematic. Aside from the generic problem of identifying the impact of the transport investment against a background of economic and social change brought about by accession to the EU and the 2007/8/9 recession, the impact of the M0 Eastern Sector is confounded with that of several major transport initiatives. Additionally, the M31 only opened to traffic at the end of July 2010 making it difficult to obtain any ex post data on this road. A final complication is that a lot of the benefits of the M0 and M31 relate to decongestion benefits in Budapest. These are hard to measure with surveys. The ex post impact of the M0 has therefore been estimated with the aid of the Budapest regional transport model.

**Results of the ex post evaluation**

In this section we provide a summary of the results of the ex post evaluation of all ten projects.

The table below provides a summary of the results of the economic analysis. For each project it indicates the NPV, IRR and benefit-cost ratio both under Low
Executive Summary

In the Executive Summary, the document discusses the case and High case scenarios. Generally, we have defined the Low case and the High case by making different assumptions about future traffic or passenger numbers. We refer the reader to the full case studies for further details regarding the assumptions underpinning each of them.

Summary findings from ex post economic analysis

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>High speed railway Madrid – Barcelona in Spain</td>
<td>NPV (€m)</td>
<td>-2,736</td>
<td>-1,948</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>2.6%</td>
<td>3.7%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>A2 Motorway in Poland</td>
<td>NPV (€m)</td>
<td>523</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>18.2%</td>
<td>22.8%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>3.0</td>
<td>4.4</td>
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<tr>
<td>Algarve railway in Portugal</td>
<td>NPV (€m)</td>
<td>48</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>6.7%</td>
<td>7.5%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>A23 Motorway in Spain</td>
<td>NPV (€m)</td>
<td>-27</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>4.6%</td>
<td>6.3%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>Agiou Konstantinou bypass in Greece</td>
<td>NPV (€m)</td>
<td>233</td>
<td>283</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>12.6%</td>
<td>13.4%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>M1 Northern Motorway in Ireland</td>
<td>NPV (€m)</td>
<td>3,805</td>
<td>3,905</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>53%</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>17.2</td>
<td>17.6</td>
</tr>
<tr>
<td>Railway Thriassio-Pedio-Eleusina-Korinthos in Greece</td>
<td>NPV (€m)</td>
<td>32</td>
<td>258</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>6.0%</td>
<td>9.3%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.1</td>
<td>1.8</td>
</tr>
</tbody>
</table>
Executive Summary

Overall, projects have so far delivered positive NPVs and benefit-cost ratios larger than 1. This means that in almost all cases the benefits of the project exceed its costs. The only exception is the LAV Madrid-Barcelona for which the benefit-cost ratio is below one. We note however that the project is not yet completed, as the last section (Barcelona – French Border) will become fully operational only in 2013.

Generally, road projects tend to yield higher benefit-cost ratios than rail projects. However, this difference is due to the specific nature of rail projects, which normally require higher levels of capital investment. This result therefore should not be interpreted as an indication that road projects are always preferable to road project. The core CBA offers only a partial vision of the full impact of a project and does not take into account all the factors that may make a rail investment preferable to a road one.

The next table summarises the results of the ex post financial analysis. For each project, we have calculated both the return on investment and the return on capital. The detailed results of the analysis are provided in each detailed case study. With regards to projects that do not generate revenues (generally roads), we note that:

- as the financial analysis does not consider the EC contributions, the financial NPV is generally negative;
- accordingly, given that the cashflow stream is negative throughout the life of the project, the IRR cannot be calculated; and,

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>IX B transport corridor in Lithuania</td>
<td>NPV (€m)</td>
<td>200</td>
<td>212</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>55%</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>3.3</td>
<td>3.4</td>
</tr>
<tr>
<td>Bratislava Rača – Trnava Railway Upgrade in Slovakia</td>
<td>NPV (€m)</td>
<td>104</td>
<td>216</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>9.7%</td>
<td>12.4%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>2.1</td>
<td>3.2</td>
</tr>
<tr>
<td>M0 Budapest Ring Road (eastern section) in Hungary</td>
<td>NPV (€m)</td>
<td>317</td>
<td>1,522</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>13.6%</td>
<td>25.8%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>2.2</td>
<td>6.8</td>
</tr>
</tbody>
</table>
while Low and High case have been defined on the basis of future traffic volumes, if no toll is applied there are no differences between the financial Low case and the financial High case.

**Summary findings from ex post financial analysis (*)**

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>High speed railway Madrid – Barcelona in Spain</td>
<td>NPV Investment (€m)</td>
<td>-4,766</td>
<td>-4,288</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Investment (%)</td>
<td>-0.4%</td>
<td>0.6%</td>
</tr>
<tr>
<td></td>
<td>NPV Capital (€m)</td>
<td>-919</td>
<td>-315</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Capital (%)</td>
<td>3.7%</td>
<td>4.5%</td>
</tr>
<tr>
<td>A2 Motorway in Poland</td>
<td>NPV Investment (€m)</td>
<td>-263</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fin IRR Investment (%)</td>
<td>-3.5%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NPV Capital (€m)</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fin IRR Capital (%)</td>
<td>11.6%</td>
<td></td>
</tr>
<tr>
<td>Algarve railway in Portugal</td>
<td>NPV Investment (€m)</td>
<td>-299</td>
<td>-299</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Investment (%)</td>
<td>-3.6%</td>
<td>-3.6%</td>
</tr>
<tr>
<td></td>
<td>NPV Capital (€m)</td>
<td>-111</td>
<td>-111</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Capital (%)</td>
<td>0.2%</td>
<td>0.2%</td>
</tr>
<tr>
<td>A23 Motorway in Spain</td>
<td>NPV Investment (€m)</td>
<td>-230</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fin IRR Investment (%)</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>NPV Capital (€m)</td>
<td>-55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fin IRR Capital (%)</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Agiou Konstantinou bypass in Greece</td>
<td>NPV Investment (€m)</td>
<td>-173</td>
<td>-166</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Investment (%)</td>
<td>-1.7%</td>
<td>-1.3%</td>
</tr>
<tr>
<td></td>
<td>NPV Capital (€m)</td>
<td>-85</td>
<td>-78</td>
</tr>
<tr>
<td></td>
<td>Fin IRR Capital (%)</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>
In most cases, the financial NPV is negative or, if positive, it is generally low. This is to be expected, as the financial analysis does not take into account the EC contribution, which is needed for these projects to be implemented.
Key sources of benefits

In this section, we identify the key benefits for each project. We consider both direct benefit (such as time savings) and positive externalities (such as road safety benefits).

- **High speed railway Madrid – Barcelona in Spain.** The main benefits generated by the new railway line come from time and vehicle operating costs savings, from passengers shifting to the new rail services from other transport modes, mainly car (44%) and to a lesser extent, traditional rail (23%) and air (16%).

- **A2 motorway in Poland.** The ex post analysis shows that the project delivers value for money in both the high and low scenarios tested. The majority of the benefits are derived from time savings and vehicle operating cost savings.

- **Algarve railway in Portugal.** The main benefits from the modernisation of the railway line are generated by time savings for rail passengers, and vehicle operating cost savings and reduction in pollution related to freight transportation. These results are in line with the findings of the original ex ante analysis.

- **A23 motorway in Spain.** The main benefits generated by the new road come from the induced time savings achieved, result of the higher speeds reached on the new road. However, the new road also results in higher vehicle operating and fuel costs than the old road. This is a result of the higher speeds reached on the new road.

- **Agiou Konstantinou bypass in Greece.** The ex post analysis shows that despite lower than forecast traffic volumes, the benefits outweigh the costs in both scenarios. The majority of the benefits are derived from considerable time savings and a small reduction in accidents. Although slightly lower than originally forecast, the results are in line with the results presented in the ex ante CBA.

- **M1 northern motorway in Ireland.** The majority of the benefits from this project come from time savings. This is because the new sections of motorway relieved a very congested area. The project has also delivered vehicle operating costs and safety benefits.

- **Railway Thriassio-Pedio-Eleusina-Korinthos in Greece.** The ex post analysis for this project shows that the project represents value for money having a BCR of greater than one in both high and low demand scenarios.
The net present value of benefits are lower than forecast, although this reflects the smaller extent of the project considered in the outturn evaluation. The initial appraisal had considered an extension of the project as far as Patra, which is not yet completed. The main benefits for the project come through travel time savings, reduced maintenance and operating costs, accident and environmental benefits.

- **IX B corridor in Lithuania.** Given the differences between the two projects, we have carried out the ex post CBA analysis separately for each project. The main benefits from the upgrading of the motorway are originated by savings in vehicle operating costs. The Vilnius Southern Bypass, on the other hand, generates most of its benefits as time savings. These results are in line with the findings of the original ex ante analysis.

- **Bratislava Rača – Trnava Railway Upgrade in Slovakia.** The main benefits of the project come through travel time savings, particularly for passengers but also for freight. A reduction of vehicle maintenance and operating costs, and a number of externality impacts – safety and environment - also contribute toward the overall project benefits. The results are in line with the findings of the original ex ante analysis submitted in the applications for funding for the two projects.

- **M0 Budapest Ring Road (eastern section) in Hungary.** The M0 Eastern Sector and the M31 have provided good value for money with high benefit cost ratios and internal rates of return. The vast majority of the benefits come from time savings. These findings are in line with the ex ante analysis. The ex post analysis indicates a lower NPV but a higher benefit cost ratio than the ex ante. This arises as the outturn investment costs and overall traffic growth across the network have been less than anticipated.

### Wider economic impacts

Quantifying the impacts of transport projects on economy; social and physical environments can be challenging. Even where quantitative data can be provided in the locality of the project, isolating successfully the project’s true impacts with a great deal of certainty is unlikely.

In order to provide an indication of the likely wider impacts of the projects considered here, we held a series of semi-structured interviews with key stakeholders. The structure of the interviews was based upon guidance set out in the Commission’s ‘Impact Assessment Guidelines’ published in January 2009. This guidance provides a detailed list of social, economic and environmental themes that should be considered when evaluating infrastructure projects. Clearly not all of these themes were of immediate relevance to all projects and
hence the themes and questions have been rationalised for the purpose of the project under evaluation. The table below summarises the key topic areas considered in the semi-structured interviews.

**Summary of topic areas considered in semi-structured interviews**

<table>
<thead>
<tr>
<th>Economy Impacts</th>
<th>Social Impacts</th>
<th>Environmental Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Development and Investment</td>
<td>Skills, Labour and Employment</td>
<td>Impact on Development, Regeneration and Land use</td>
</tr>
<tr>
<td>Internal Markets, Competitive Trading and Investment</td>
<td>Quality of Life and Community Impacts</td>
<td>Sustainable Travel</td>
</tr>
<tr>
<td>Administrative Burdens and Public Authorities</td>
<td>Public Health and Safety</td>
<td>Climate and Air Quality</td>
</tr>
<tr>
<td>Property and Land Values</td>
<td>Quality of Life and Community Impacts</td>
<td>Biodiversity</td>
</tr>
<tr>
<td></td>
<td>Cultural Impacts</td>
<td>Water and Soil Quality</td>
</tr>
<tr>
<td></td>
<td>Impact on Development, Regeneration and Land use</td>
<td>Production of Waste</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Impacts</td>
</tr>
</tbody>
</table>

We note that the wider impact of a project depends largely on its scale and on whether it is a new infrastructure or not. That is the reason why we have identified more impacts for projects that delivered a new railway or road. Accordingly, the wider impact discussion for these projects is more extensive. On the other hand, projects that involved upgrading existing infrastructures are more likely to generate benefits such as time savings and vehicle operating costs savings. These benefits are already fully captured by the core CBA methodology.

In this section we provide a brief overview of the socio-economic impacts of these projects. For further detail we refer the reader to the full case studies.

- **High speed railway Madrid – Barcelona in Spain.** A study supporting this ex post evaluation of the Madrid-Barcelona high speed train (HST) investment (Ballet, 2010) identifies that most studies carried out on wider socio-economic impacts conclude the HST is not a sufficient condition to cause major transformations in the cities and regions connected by it. The HST only facilitates socio-economic changes that may be already underway. However, the same study also points out that access to HST services may provide important competitive advantages to those cities that are on the HST network compared with those that are not in the network and have therefore less train services. According to the economic literature and experience in other European countries where HST services have been introduced before suggest the main wider economic impacts of HST infrastructure and services are impact on mobility and accessibility, socio-economic structures, urban image and spatial effects. The same applies to the cities connected by the Madrid-Barcelona HST line, particularly Zaragoza and Lleida. In sum, in terms of wider economic impacts, the
Executive Summary

advantages provided by the HST may accompany or support wider economic changes that are already underway rather than induce or generate new changes.

- **A2 motorway in Poland.** The project was implemented during a period of rapid economic growth in Poland, so the wider socio-economic impacts directly attributable to the project are difficult to establish. However, it is clear from our discussions with local and regional stakeholders that the project has been instrumental in improving connectivity at a local and regional scale. Anecdotal evidence from our discussions also highlighted evidence of increased tourism, development of new industries, and improvements to quality of life.

- **Algarve railway in Portugal.** Most of the impacts of this project (which involved upgrading an existing infrastructure) come from time and vehicle operating cost savings. These effects are already largely captured by the core ex post CBA methodology.

- **A23 motorway in Spain.** The construction of these segments of the A23 has attracted several developments to the region, both in the Teruel and Huesca provinces. In most cases, these relate to the development of industrial and technological parks in the area of influence of the new road. The whole A23 has had other impacts, but these are more related to other segments of the road, not considered in the current analysis.

- **Agiou Konstantinou bypass in Greece.** The project was clearly developed to alleviate a specific bottleneck in the Greek highway network which has now been removed. However, our discussions with local stakeholders have identified a number of additional indirect impacts attributable to the project. Loss of passing trade in Agios Konstantinos has been a concern, although it is anticipated that this will be outweighed by increased tourism because access to the beach area has improved following the removal of through traffic. There are also longer term plans to further improve the access to the seafront from the town by downgrading the old road. Clearly this would not have been an option prior to the project.

- **M1 northern motorway in Ireland.** It is difficult to establish a link between the project and wider socio-economic impacts as the project was implemented during a period of rapid growth in the Irish economy. It is however clear that the project has formed an important component of the general upgrade of the Ireland’s transport network. The construction of the project was a key factor in facilitating the construction of the second terminal at Dublin Airport. There is also evidence of substantial growth in
the towns adjacent to the project – where the congestion levels have dropped as a result of the M1 Northern Motorway.

- **Railway Thriassio-Pedio-Eleusina-Korinthos in Greece.** The project has had a number of impacts:
  - the peripheral location of the stations relative to the towns they serve means that they are poorly accessible compared to the stations located on the old routes;
  - the out-of-town stations do offer a focal point for development and have been integrated into local town master planning exercises;
  - the removal of trains from the built up areas has offered local congestion benefits and associated benefits in terms of noise, poor air quality and congestion caused by traffic disruption at level crossings;
  - the true wider impacts of the project are unlikely to materialise until the line completes the rail link between Patra port with Athens.

- **IX B corridor in Lithuania.** The project was implemented against a backdrop of rapid economic growth. Therefore, it is difficult to establish a causal link between it and specific impacts. Nonetheless, it is clear that the project contributed significantly to the upgrading of the Lithuanian transport network. Together with other projects, it helped set up Free Economic Zones and open new logistic centres. It also contributed to the regeneration of brownfields along the motorway (for example with the set up of new shopping and residential centres).

- **Bratislava Rača – Trnava Railway Upgrade in Slovakia.** The project was implemented during a period of rapid economic growth and increasing car ownership. Therefore the passenger numbers on the line have fallen relative to 2005 levels. Moreover, the continued works on other segments of the line have caused delays and cancellations further contributing to the fall in passenger numbers. Additionally, due to the global economic recession in 2008/2009, it is difficult to attribute regional development impacts directly to the project. However, the project has contributed to meeting aspirations of Slovak transport policy to increase accessibility to wider EU markets and is successful in improving communication and trade links between the two major economic centres of Bratislava and Košice. Furthermore, the improved link offers increased accessibility to jobs located in the major urban areas of Bratislava and Trnava.

- **M0 Budapest Ring Road (eastern section) in Hungary.** The M0 Eastern Sector and M31 are youthful in terms of their age and their expected economic life. The M0 opened 2 years ago and the M31 a matter of weeks...
ago. As such, their impacts on society and the economy are limited as it takes time for direct transport benefits to feed through into society and the economy. Additionally, the recession has affected the economy throughout the period the M0 has been open. Primarily as a consequence of their youthfulness quality of life benefits/costs (accessibility, air quality and noise disturbance) are those most readily observable. There has, however, been some economic development along the M0 corridor (retail and logistic centres) and it is expected that more will occur, as municipalities are zoning more land in the locality of the M0.

**Review of the ex ante CBA analysis**

As part of the study, we have review the ex ante CBA analysis underpinning the original funding applications. We discuss our findings briefly below. Each case study provides a detailed review of the respective ex ante analysis.

- **Good quality of analysis.** Overall, the quality of the ex ante CBA appears to be good. In all cases the analysis was undertaken following the methodology defined by each Member States. For projects planned in the late 1990s and early 2000s, differences in national methodologies are reflected in the analysis undertaken. However, over time most Member States have gradually adopted the EC guidelines, thus reducing the extent of inconsistencies.

- **Limited analysis of alternative options.** In most cases, the ex ante CBA was carried out for a single implementation option. This is because in many instances the project had already been defined as part of a wider national investment policy. In this cases, the ex ante CBA is mainly an exercise necessary for the funding application rather than a tool to choose between alternative implementation options.

- **Limited use of sensitivity analysis.** In most case, the use of sensitivity analysis is limited to assessing how the financial NPV and IRR of the project would vary depending on the level of EC contribution received. In some cases, some sensitivity analysis on traffic volumes and costs has been done, although its scope remains modest.

- **Documentation not sufficiently comprehensive.** The documentation provided as part of the application is often not comprehensive enough. The funding application form only requires the results of the analysis and not a description of the methodology used. However, in most cases the ex ante CBA report is provided as an annex. This notwithstanding, these report tend to be not sufficiently detailed. Reviewing the actual analysis undertaken is therefore challenging.
Comparison of ex ante and ex post analysis

The table below provides a comparison of the ex ante and ex post results. To ensure consistency, whenever possible we have carried out the ex post analysis using an approach similar to the one underpinning the ex ante analysis. Therefore, the ex ante and ex post results are generally comparable with one another. However, there are two main exceptions.

- **LAV Madrid – Barcelona.** The ex ante cost benefit analysis reports the *economic* and the *social* net benefits of the project. Social benefits equal economic benefits plus external benefits. Instead of producing the benefit-cost ratio of the project, the ex ante cost benefit analysis reports the benefit-investment ratio. This ratio is not directly comparable with the ex post BCR.

- **Railway Thriassio-Pedio-Eleusina-Korinthos in Greece.** ERGOSE did not carry out separate ex ante CBAs for each funding application, and refer to the benefits as a result of the entire Thriasio-Patra improvement. However, the section of line between Kiato and Patra has not yet been completed and as such the ex post evaluation of the project life benefits does not include the benefits likely to emerge once the remaining part of the line between Kiato and Patra is completed. For this reason, the ex post monetary benefits of the project should not be expected to be of the same order of magnitude as reported in the ex ante CBA.

Overall, the ex post CBAs yield NPVs and benefit-cost ratios than are in line with the results identified in the ex ante. Therefore, our analysis has confirmed that most of these projects’ benefits outweigh the costs. There are however some exceptions. These include the high-speed railway in Spain, when the benefit-cost ratio is lower than 1 (albeit close to it) and the A23 motorway in Spain, where higher speed has led to higher vehicle operating costs and fuel consumption.

### Comparison of ex ante and ex post cost-benefit analysis

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Ex ante</th>
<th>Ex post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low case</td>
<td>High case</td>
</tr>
<tr>
<td>LAV Madrid to Barcelona</td>
<td>NPV (€m)</td>
<td>314 - 2,759</td>
<td>-1,610 -618</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>6.3% - 8.9%</td>
<td>3.9% 5.0%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>0.1 – 0.4</td>
<td>0.8 0.9</td>
</tr>
</tbody>
</table>
## Executive Summary

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Ex ante</th>
<th>Ex post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Low case</td>
<td>High case</td>
</tr>
<tr>
<td><strong>A2 Motorway in Poland</strong></td>
<td>NPV (€m)</td>
<td>1,867</td>
<td>523</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>20.2%</td>
<td>18.2%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>3.1</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Algarve railway in Portugal</strong></td>
<td>NPV (€m)</td>
<td>157</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>9.1%</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.6</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>A23 Motorway in Spain</strong></td>
<td>NPV (€m)</td>
<td>120</td>
<td>-28</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>9.1</td>
<td>4.6%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.6</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Agiou Konstantinou bypass in Greece</strong></td>
<td>NPV (€m)</td>
<td>422</td>
<td>233</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>17.6%</td>
<td>12.6%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>3.1</td>
<td>2.1</td>
</tr>
<tr>
<td><strong>M1 Northern Motorway in Ireland</strong></td>
<td>NPV (€m)</td>
<td>303</td>
<td>3,805</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>16</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>5.5</td>
<td>17.2</td>
</tr>
<tr>
<td><strong>Railway Thriassio-Pedio-Eleusina-Korinthos in Greece</strong></td>
<td>NPV (€m)</td>
<td>396</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>7.3%</td>
<td>6.0%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.5</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>IX B transport corridor in Lithuania</strong></td>
<td>NPV (€m)</td>
<td>83</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>21.8%</td>
<td>55%</td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>2.5</td>
<td>3.3</td>
</tr>
</tbody>
</table>
Executive Summary

### Role of ex ante cost benefit analysis

This section presents, for each project, the evidence gathered regarding the role of the ex ante cost benefit analysis in the decision making process of each Member State.

- **High speed railway Madrid – Barcelona in Spain.** Discussions held with ADIF, the Spanish railway infrastructure operator, confirmed that the department responsible for the use of CBA in this project is the General Directorate for Railway Infrastructures in the *Ministerio de Fomento* ("Fomento"), which, in Spain, is the equivalent of a ministry for public works. The preparation of the business case for the project, including the ex ante CBA, largely followed the CBA technical methodologies developed by *Fomento*, including an Investment Manual (2000, 2009). ADIF confirmed that the 2009 version of the Investment Manual adopts the recommendations of the Commission, in particular those in DG Regio’s 2008 CBA Guidelines. ADIF works with the ex ante CBA model prepared by *Fomento* and is in charge of reviewing the demand and cost estimates as the project gets implemented. ADIF claimed that the updating of the financial and economic model translates into reduced uncertainty regarding demand figures and total costs. ADIF did not provide details about unforeseen events related to the technical complexities of the project (e.g. soil conditions or access to Barcelona Sants railway station) resulted in some differences between projected and out-turn costs and forecasts. While ADIF could not comment on the uses of ex ante CBA by *Fomento*, they confirmed that, in addition to ex ante CBA, *Fomento* also commissions studies which use a multi-criteria methodology.

### Table: Cost Benefit Analysis

<table>
<thead>
<tr>
<th>Project</th>
<th>Indicator</th>
<th>Ex ante Low case</th>
<th>Ex ante High case</th>
<th>Ex post Low case</th>
<th>Ex post High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bratislava Rača – Trnava Railway Upgrade in Slovakia</td>
<td>NPV (€m)</td>
<td>-1.1</td>
<td>104</td>
<td>216</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>9.9%</td>
<td>9.7%</td>
<td>12.4%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>1.0</td>
<td>2.1</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>M0 Budapest Ring Road (eastern section) in Hungary</td>
<td>NPV (€m)</td>
<td>1,177</td>
<td>317</td>
<td>1,522</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IRR (%)</td>
<td>16.1%</td>
<td>13.6%</td>
<td>25.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B/C ratio</td>
<td>3.2</td>
<td>2.2</td>
<td>6.8</td>
<td></td>
</tr>
</tbody>
</table>
• **A2 motorway in Poland.** Discussions held with the relevant stakeholders have revealed that CBA was not used as a tool to prioritise between alignments for this pilot project as the alignment had been set many years before EU accession. Our discussions revealed that Poland has a national priority to build up its motorway network, only after this has been achieved will CBA be more comprehensively used to prioritise projects or options. Furthermore there was a general consensus that it was political influence determining which projects progress and not the outcome from CBA which at most confirms the extent to which a chosen project offers value for money. This was also a view that Member States regard CBA as a hurdle to jump in order to secure funding and the “go versus no go” scenario rarely exists.

• **Algarve railway in Portugal.** REFER, the infrastructure manager of the rail network in Portugal and developer of this project, told us that, at the time of the initial project design (the late 1990s), they did not use the ex ante CBA to inform decisions concerning which projects to implement and, within each project, which construction options to choose. At that time, the motivation underpinning investment decisions did not originate from economic analysis. Rather, they were driven by overall policy objectives. For this specific pilot project, the ex ante CBA was carried out mainly to comply with EU requirements for funding applications, but not to inform the decision making process. However, REFER also told us that their internal procedures are now significantly different. Currently, REFER carries out a detailed ex ante CBA for each project under consideration. The CBA is used not only to decide which overall project should be prioritised, but also to choose between alternative implementation options. The results of the ex ante CBA are included in the documentation submitted to the Board. The Board bases its decision also on the results of the CBA. For example, REFER told us that recently the Board turned down an investment proposal on another railway line due to the fact that it had an unsatisfactory net present value.

• **A23 motorway in Spain.** We have talked with Ministerio de Fomento - Unidad de Carreteras de la Demarcación de Aragón regarding the role of CBA in the decision making process. We have received confirmation that the decision to construct the A23 was mainly political. Despite this, the decision among different alternatives regarding the exact configuration of the road was based on two economic analyses undertaken by the Demarcación de Carreteras del Estado en Aragón.

• **Agiou Konstantinou bypass and Railway Thriassio-Pedio-Eleusina-Korinthos in Greece.** We held a workshop with representatives from the Greek Ministry of Economy and Public Works and stakeholders
representing both the Agios Konstantinos project and also the Thriasio to Korinthos Rail project. The CBA was recognised as being both a necessary procedure to complete the funding application and a useful tool for prioritising options within projects where alternative options can be tested. It was noted that a CBA is normally not prepared for smaller local projects. In the case of both the Agios Konstantinos Bypass and the Thriasio to Korinthos railway, the CBA was not used as a tool to compare alternative options. For the bypass in particular, there was little potential for alternative route options due to the difficult topography in the area.

- **M1 northern motorway in Ireland.** We discussed the role of ex ante and ex post cost-benefit analysis with the National Roads Authority in Ireland. When the structural funds were introduced, Ireland had already implemented a framework for road transport appraisal. The current appraisal guidelines for national road subprojects are described in full on their website. They are in full compliance with the Department of Finance guidance on the appraisal and management of capital expenditure proposals in the public sector. This report also provides details on how Ireland complies with the regulations associated with the Cohesion Funding.

- **IX B corridor in Lithuania.** In Lithuania, the ex ante CBA is not used to choose between alternative projects competing for limited funding. In fact, most projects involve the improvement and upgrading of existing infrastructures. These projects have already been identified in the National Transport Development Plan as investments that need to be undertaken. In most cases, there are no alternative options for implementation and it would be unnecessarily costly to identify unfeasible alternatives just for the purposes of the analysis. For example, in the case of the upgrading of an existing road, the link route is already defined (and often already in use). Instead, the Lithuania Road Administration uses ex ante CBA as a way to identify the project specifications (such as the design of a junction) and technologies (such as the asphalt type) that would yield the best value for money. The LRA carry out the analysis for each specific part of the project independently, without recalculating the entire NPV and BCR for the whole project. Therefore, the analysis that the LRA carries out is not a full CBA as such. Nonetheless, the LRA sees ex ante appraisal as a useful tool to avoid the “gold plating” of projects and to make specific implementation decisions.

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1 For the NRA website see [http://www.nra.ie/Publications/ProjectAppraisal/](http://www.nra.ie/Publications/ProjectAppraisal/)


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**Executive Summary**
Bratislava Rača – Trnava Railway Upgrade in Slovakia. The Slovak rail infrastructure manager (ŢSR) informed us that this project formed one element of wider aspirations to upgrade the full rail Corridor Va to support line speeds of up to 160km/hr across Slovakia. With the rail line already in existence and with this scheme involving upgrade work, no alternative options for improvements were considered. In respect to this point, and in the case of this project, the ŢSR understands the CBA process to be a thorough assessment carried out in order to receive funding. They advocated that projects across Slovakia could not be funded through government money and therefore were happy to undertake the CBA assessment and meet required EU guidelines in order to obtain the required funding necessary for undertaking their projects.

- M0 Budapest Ring Road (eastern section) in Hungary. Our discussions with the relevant stakeholders indicated that CBA was and continues to be useful to the Hungarian authorities for not only providing a summary of impacts, but also within a particular strategy for selecting between projects and choosing between alignments. Thus, within the Expressway strategy (the development of the motorway network in Hungary), CBA helps prioritise which projects to promote first and then to help choose alignments for those projects. It is evident that in Hungary there is a tension between the economic efficiency analysis of a CBA and the environmental impacts of a project. The stakeholders we consulted informed us that the environmental stakeholders hold little or no regard for the CBA – their primary role is the safeguarding of the environment. As a result the process of obtaining an environmental permit for a new infrastructure project can involve protracted negotiations. They cited an example of the proposed M8 project in Central Hungary where after years of discussion an alignment has finally been agreed. They were keen to look for new and better ways to incorporate environmental impacts into the CBA.

Conclusions

As noted above, the objective of this Second Interim Report is to present the results of each of the ten ex post evaluations, to inform further discussion both internally within the study team and at Steering Group level. At this stage, we have not yet attempted to identify unifying themes and general conclusions, which will be discussed, along with recommendations about the evaluation methodology and the future role of CBA, in the Final Report.

This notwithstanding, at this stage we offer some observations based on our experience with the evaluation of the ten case studies. Some of these results confirm the preliminary findings we had identified when carry out the evaluation of the Pilot Case Studies.
Satisfactory ex post benefit-cost ratio. Overall, projects have so far delivered positive NPVs and benefit-cost ratios higher than 1. This means that in almost all cases the benefits of the project exceed its costs. The only exception is the LAV Madrid-Barcelona for which the benefit-cost ratio is just below one. We note however that the project is not yet completed, as the last section (Barcelona – French Border) will become fully operational only in 2013.

Road projects vs. rail projects. Generally, road projects tend to yield higher benefit-cost ratios than rail projects. However, this difference is due to the specific nature of rail projects, which normally require higher levels of capital investment. This result therefore should not be interpreted as an indication that road projects are always preferable to rail projects. The core CBA offers only a partial assessment of the full impact of a project and does not take into account all the factors that may make a rail investment preferable to a road one.

Elapsed time since opening. The majority of the projects we have reviewed opened relatively recently, in some cases as late as the end of 2009. The short elapsed time since project opening raises two issues with the ex post evaluation:

- while we obtained outturn information on project costs, we needed to make assumptions about future traffic levels. In the absence of historical traffic data, this has led to a high degree of uncertainty in the calculation of project benefits, especially in the context of the current global economic downturn; and,
- with the exception of very large infrastructure projects (such as the high speed railway line between Madrid and Barcelona), wider impacts generally take a significant period of time to emerge. For this reason, our analysis might have not considered effects that will materialise only in future.

Identification of wider impacts. The lack of project monitoring frameworks, implemented at project opening, makes the identification of wider impacts particularly challenging. This is especially the case for projects being implemented as part of a wider modernisation strategy, against a backdrop of rapid economic growth in the early 2000s and infrastructure investments. In these cases, identifying a causal link between a project and wider socio-economic impacts is challenging.

Wider impacts come predominantly from new infrastructures. In terms of wider impacts, there is a significant difference between new
infrastructures and upgrades of existing infrastructures. With regards to new infrastructures, socio-economic impacts tend to be significant and more easily identifiable, even anecdotally. With regards to upgrades, most of the benefits originate from time savings and vehicle operating costs savings, and from benefits caused by improved road safety. These impacts tend to be fully captured in the application of the standard CBA analysis.

- **Co-ordination of different groups of stakeholders.** As identified in the First Interim Report, we found that the number of stakeholders involved with a project can delay their engagement with the study and the provision of information. This is particularly the case for rail projects, some of which had been implemented by the national railway company before the unbundling of network and train operations. This implies that the information underpinning the ex ante analysis may be split between two different companies.

- **Loss of institutional memory.** In terms of planning and design, most of the projects we have considered in this study date back to the late 1990s. This was also the time when sponsoring organisations carried out their first comprehensive cost-benefit analyses. Due to the time elapsed, some of the institutional memory regarding the ex ante analyses has inevitably been lost. This issue is likely to be more significant for the evaluation of earlier projects.
1 Introduction

Frontier Economics, together with Atkins and the Institute of Transport Studies, University of Leeds, are pleased to present this Second Interim Report for the “Ex post evaluation of cohesion policy interventions 2000-2006 financed by the Cohesion Fund – Work Package B: Cost-benefit analysis of selected transport projects”.

1.1 Objective

Following the completion of the Project Descriptions report (the second deliverable for this study), DG REGIO selected the ten projects to be taken forward in this study, which completed Task 1 of this study. The objective of Task 2 is to carry out an in-depth ex post CBA for ten selected transport projects.

Table 1 summarises the ten projects selected for Task 2 of the study, grouping them by region and transport mode.

<table>
<thead>
<tr>
<th></th>
<th>Road</th>
<th>Rail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece/Ireland/Portugal/Spain</td>
<td>• M1 motorway – Ireland</td>
<td>• Railway line Thriassio-Pedio-Eleusina-Korinthos – Greece</td>
</tr>
<tr>
<td></td>
<td>• Agiou Konstantinou bypass – Greece</td>
<td>• Modernisation of the Algarve rail line - Portugal</td>
</tr>
<tr>
<td></td>
<td>• Levante – Francia motorway - Spain</td>
<td>• High-speed rail line Madrid-Barcelona-French border – Spain</td>
</tr>
<tr>
<td>Central and Eastern Europe</td>
<td>• IXB Transport Corridor – Lithuania</td>
<td>• Modernisation of the railway line Senkevice-Cifer and stations Raca-Trnava – Slovak Republic</td>
</tr>
<tr>
<td></td>
<td>• Construction of A2 Motorway – Poland</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Eastern Section of the M0 Budapest Ring Road between National Road 4 and M3 – Hungary</td>
<td></td>
</tr>
</tbody>
</table>

Source: DG REGIO (following recommendation by Frontier Economics, Atkins and ITS)

Task 2 is at the core of the study. As indicated in the Terms of Reference (“TORs”), it is subdivided into three sequential subtasks, which need to be carried out for each of the selected projects:
Introduction

- Task 2.1 – A review of ex ante cost-benefit analysis, to assess the quality of the analysis carried out at the time of the funding application and its usefulness in the decision purpose.
- Task 2.2 – An ex post cost-benefit analysis of the project under consideration, calculating the outturn Net Present Value, Internal Rate of Return and Benefit-Cost Ratio.
- Task 2.3 – A comparison of ex ante and ex post cost benefit analyses, trying to identify the causes of possible discrepancies between ex ante and ex post analysis.

As requested by the TORs, we have based our methodology on the most recent European Commission’s guide to cost-benefit analysis ('the EC Guide').

The Terms of Reference of the study require the full analysis to be completed first for two pilot projects, to test the methodology and refine it before the remainder of the analysis for the remaining eight projects is carried out. The two pilot projects that DG REGIO chose were:

- Pilot 1: Construction of the A2 motorway between Konin and Strykow, Poland
- Pilot 2: Modernisation of the Lisbon - Algarve railway, Portugal

The results of this analysis were presented in the First Interim Report at the end of last May. Following the submission of the report, we discussed how our methodology could be improved to better fulfil DG REGIO’s objective for this study taking account of the feedback from the Steering Group and the external experts.

The methodology we have used in this Second Interim Report is therefore an amended version of the approach we used for the Pilot case studies. In particular, we have modified our approach to:

- enhance the description of the socio-economic context for each project;
- presenting their strategic objectives; and,
- understanding the wider impacts attributable to each project, over and above those included in the core cost-benefit analysis.

This Second Interim Report provides the results of the ten ex post evaluations. The degree of completion of such evaluation differs across the set of projects. The main objective of this Report is to inform the subsequent discussion, both

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internal and at Steering Group level, regarding the findings and recommendations of the study. We will address remaining information gaps, and a fuller set of findings and recommendations in the Final Report. For this reason, while we have provided some overall observations on the expected final results of the study in the conclusions section, we have not yet attempted to fully identify key unifying messages and themes emerging from the ex post evaluation exercise.

1.2 Wider impacts assessment

In the case studies for this Second Interim Report, we have focused more on determining the wider impacts of each project. Quantifying the wider impacts of transport projects on economic, social and physical environments can be challenging. Normally, these are those impacts which cannot be included in the standard CBA, for a variety of reasons. These include:

- the lack of an agreed methodology to identify their monetary value;
- the lack of data, which would make the quantification impossible even if data was available; and,
- the difficulty to isolate a project’s true impacts with a great deal of certainty, especially in the context of rapidly changing environments (for example, in the newer Member States).

Therefore, the approach we have used for these impacts was largely qualitative. In order to provide an indication of the likely wider impacts of the projects considered here, we held a series of semi-structured interviews with key stakeholders. The structure of the interview, shown in detail in Annexe 2, is based upon guidance set out in the Commission’s ‘Impact Assessment Guidelines’ published in January 2009. This guidance provides a detailed list of social, economic and environmental themes that should be considered when evaluating infrastructure projects. Clearly not all of these themes were of immediate relevance to all projects and hence the themes and questions have been rationalised for the purpose of the project under evaluation. Table 2 summarises the key topic areas considered in the semi-structured interviews.
Table 2. Summary of topic areas considered in semi-structured interviews

<table>
<thead>
<tr>
<th>Economy Impacts</th>
<th>Social Impacts</th>
<th>Environmental Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Development and Investment</td>
<td>Skills, Labour and Employment</td>
<td>Impact on Development, Regeneration and Land use</td>
</tr>
<tr>
<td>Internal Markets, Competitive Trading and Investment</td>
<td>Quality of Life and Community Impacts</td>
<td>Sustainable Travel</td>
</tr>
<tr>
<td>Administrative Burdens and Public Authorities</td>
<td>Public Health and Safety</td>
<td>Climate and Air Quality</td>
</tr>
<tr>
<td>Property and Land Values</td>
<td>Cultural Impacts</td>
<td>Biodiversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water and Soil Quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Production of Waste</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other Impacts</td>
</tr>
</tbody>
</table>

In addition to these impacts, there may be others that should be included in the cost-benefit analysis but, in some specific cases, were not taken into account. These are mainly environmental impacts, ranging from impact on groundwater pollution to noise and CO2 emissions. Whenever applicable, we discussed them, in a qualitative way, during the semi-structure interview on wider impacts. In these cases, we were mindful of not double-counting them in the actual cost-benefit analysis.

We note that the wider impact of a project depends largely on its scale and on whether it is a new infrastructure or not. That is the reason why we have identified more impacts for projects that delivered a new railway or road. Accordingly, the wider impact discussion for these projects is more extensive. On the other hand, projects that involved upgrading existing infrastructures are more likely to generate benefits such as time savings and vehicle operating costs savings. These benefits are already fully captured by the core CBA methodology.

1.3 Structure

The structure of this document is as follows.

- chapters 2 to 11 present a summary of the analysis of the ten case studies;
- chapter 12 provides our conclusion on the results of the ex post evaluation;
- annexe 1 offers an illustration of the Rule of Half, a technique used in transport appraisal to estimate consumers’ benefits;

Introduction
• annexe 2 presents the structure that we followed for the stakeholder interviews, which focused on the use and effectiveness of CBA, as well as the wider impact of the projects under consideration; and,

• appendices 1 to 10 contain the full case studies for the ten projects considered in this evaluation.
2 High speed railway Madrid – Barcelona in Spain

2.1 Project characteristics

The LAV (Línea de Alta Velocidad) Madrid – Barcelona – French border is a high speed railway line connecting Madrid to the French border via Barcelona. The Madrid – Barcelona section is already operational. The remaining section along the coast to the French border is currently under construction; therefore we have therefore excluded it from this evaluation.

The line connects the two most densely populated urban areas in Spain, Madrid and Barcelona, with intermediate connections in Guadalajara, Calatayud Zaragoza, Lleida, Tarragona (station in Camp de Tarragona, between Tarragona and Reus).

The LAV is part of the TEN-T Priority Project 3 (high-speed railway axis of south-west Europe), whose main objective is to provide high-speed rail connections between the Iberian Peninsula (Portugal and Spain) and the rest of Europe.

The High speed railway between Madrid and Barcelona covers 621 kilometres, and it was developed in three stages:

- Section Madrid – Lleida: opened in October 2003, and covering around 442 km of high speed rail.
- Section Lleida – Tarragona: in operation since December 2006, adding 78 km of railway line to the previous section.
- Section Tarragona – Barcelona (Sants station): operational since February 2008, with an additional length of 100 km.

The LAV is still under construction in the section Barcelona to Figueres in Spain, with 132 km expected to be completed in 2012. The section between Figueres and Perpignan in France was completed in 2008.

The project, as defined in the TORs, comprises 12 subprojects that account for the construction of 72 km of rail bed and the installation of 610 km of railway tracks. The total cost of the 12 subprojects was around €1,719 million, of which €1,442 million was eligible for funding. The total Cohesion Fund contribution for these subprojects in the period 2000-2006 was around €1,042 million, equal to 72.25% of the eligible project costs.
2.2 Ex post CBA

2.2.1 Results of analysis

To capture the uncertainty about future benefits, two alternative scenarios were identified: a pessimistic one (low case) and an optimistic one (high case). These two scenarios use different assumptions regarding the traffic growth on the services using the new rail line, from 2009 onwards.

The following table summarises the results of the ex post analysis for each scenario.

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Present Value (€m)</strong></td>
<td>-2,736</td>
<td>-1,948</td>
</tr>
<tr>
<td><strong>Economic IRR (%)</strong></td>
<td>2.63%</td>
<td>3.70%</td>
</tr>
<tr>
<td><strong>Benefit-cost ratio</strong></td>
<td>0.6</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: Own calculation

An ex post financial analysis for the whole project was also performed. We have calculated the annual cash flows related to the new rail services using the infrastructure. The table below summarises the results of the ex post financial analysis using a 5% discount rate.

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Present Value – Investment (€m)</strong></td>
<td>-4,766</td>
<td>-4,288</td>
</tr>
<tr>
<td><strong>Financial IRR – Investment (%)</strong></td>
<td>-0.45%</td>
<td>0.65%</td>
</tr>
<tr>
<td><strong>Net Present Value – Capital (€m)</strong></td>
<td>-919</td>
<td>-351</td>
</tr>
<tr>
<td><strong>Financial IRR – Capital (%)</strong></td>
<td>3.7%</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

Source: Own calculation

2.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** Most of its benefits come from passengers’ time saving and vehicle operating cost savings. There is also benefit from positive
externalities such as the reduction in noise, pollution, accidents and climate change effects.

- **Wider impacts** (*addresses* “Costs and benefits that cannot be expressed in monetary form”). A study supporting this ex post evaluation of the Madrid- Barcelona high speed train (HST) investment, Bellet (2010), identifies that most studies carried out on wider socio-economic impacts conclude the HST is not a sufficient condition to cause major transformations in the cities and regions connected by it. The HST only facilitates socio-economic changes that may be already underway. However, the same study also points out that access to HST services may provide important competitive advantages to those cities that are on the HST network compared with those that are not in the network and have therefore less train services. According to the economic literature and experience in other European countries where HST services have been introduced before suggest the main wider economic impacts of HST infrastructure and services are impact on mobility and accessibility, socio-economic structures, urban image and spatial effects. The same applies to the cities connected by the Madrid-Barcelona HST line, particularly Zaragoza and Lleida.

- **Meeting environmental requirements.** The environmental impacts of the LAV Madrid – Barcelona were taken into account in the cost-benefit analysis, using marginal cost parameters defined by Ministerio de Fomento. The parameters cover the following main impacts: noise, pollution, climate change (CO2 emissions), nature and landscape and impacts on the urban environment (such as congestion).

- **Utilisation.** We have calculated utilisation rates for the 2008 and 2009, using the passenger data related to the rail services using the LAV Madrid – Barcelona provided by RENFE. The resulting capacity utilisation is equal to 61% in 2008 and 57% in 2009. The contribution to this indicator by the high-speed rail services using exclusively the LAV Madrid-Barcelona is equal to 79% in 2008 and 67% in 2009.

- **Unit costs.** We requested unit costs to the most disaggregated level, but only outturn unit costs were only available for Level 1 and very few Level 2 indicators. Our analysis shows that the Level 1 unit cost was about €14m per km. Among the Level 2 indicators, we note that the unit cost of stations was about €79m, while the unit cost for both tunnels and bridges was around €24m.

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Main project risks and consequences. The key risks for the project were already identified at the time of the ex ante analysis. We have not been able to identify any additional risks envisaged, except for a possible unexpected fall in demand, arising, for example, from competing modes such as road and air travel. This would obviously have the effect of slightly decreasing the projects’ economic and financial returns.

Accompanying actions (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). With the exception of information campaigns (on national newspapers, radio, television and websites) no other action to enhance the project success was undertaken.

Unintended effects. The project does not appear to have had any unintended effects. As shown by the results of the ex post evaluation, the project addressed real need.

2.3 Ex ante CBA

2.3.1 Results of analysis

The first assessment for the LAV Madrid – Barcelona – French border was elaborated by the Ministerio de Fomento in 19975 and it was used to prepare the applications for funding for subprojects 1999ES16CPT001, 2000ES16CPT003 and 2000ES16CPT005. This cost-benefit report was later updated in May 2001 by INECO.6 This study covers the 1997 – 2025 period. As it is the most complete, we focus our ex ante review on this analysis.

The CBA report presents the results of the calculations of benefits and costs for each year of the appraisal period. The CBA distinguishes between economic analysis (Evaluación económica) and social analysis (Evaluación social), the latter includes positive externalities environmental benefits and employment generation.

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5 “Estudio de optimización funcional de la Línea de alta velocidad Madrid – Zaragoza – Barcelona – Frontera Francesa”

Table 5. Results of ex ante cost benefit analysis for the whole line

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 2005 prices)</th>
<th>Economic IRR (%)</th>
<th>BIR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Economic Analysis</strong></td>
<td>313.57</td>
<td>6.29%</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Social Analysis</strong></td>
<td>2,758.55</td>
<td>8.92%</td>
<td>0.38</td>
</tr>
</tbody>
</table>


The ex ante CBA shows a separate financial analysis for the infrastructure operator (ADIF) and for the railway operators. For this matter, access charges to be paid to the infrastructure manager are calculated in such a way that the railway operators’ profitability is 9%. The table below presents the results of the financial analysis for the whole line. INECO calculated the financial NPV using a 6% discount rate.

Table 6. Results of ex ante cost benefit analysis for the whole line

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 2005 prices)</th>
<th>IRR (%)</th>
<th>BIR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infrastructure manager</strong></td>
<td>-7,946.17</td>
<td>-3.82%</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Railway operators</strong></td>
<td>309.41</td>
<td>9.00%</td>
<td>1.6</td>
</tr>
</tbody>
</table>


2.3.2 Key aspects of the ex ante CBA

- Quality of analysis (addresses “Validity of assumptions made during the ex ante analysis”). The ex ante documentation that we have reviewed is of good quality. Generally, the approach followed in the INECO report is in line with the official guidelines of the Ministerio de Fomento and the methodology used for the analysis is well specified.

Strengths of the ex ante CBA include good reference to sources of parameters used in the analysis and the inclusion of sensitivity analysis related to investment cost and demand for the infrastructure manager and for the railway operator.

The ex ante CBA prepared by INECO has some weaknesses. Among them, we can highlight the fact that it only considers the option implemented, details on the methodology used to forecast demand are insufficient and no
monitoring mechanism is established in order to scrutinize the actual benefits following scheme approval.

- **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). The ex ante documents include a sensitivity analysis. Specifically, the analysis considers different investment cost and demand scenarios. Because the operator’s profitability is fixed at 9%, the effect of the sensitivity analysis is only observed on the ADIF’s profitability. We note that in all cases the NPV for ADIF is negative.

### 2.3.3 Role of ex ante CBA

Discussions held with ADIF, the Spanish railway infrastructure operator, confirmed that the department responsible for the use of CBA in this project is the General Directorate for Railway Infrastructures in the Ministerio de Fomento (“Fomento”), which, in Spain, is the equivalent of a ministry for public works. The same Directorate is responsible for feasibility studies related to large transport infrastructure investments.

The scope of this project was approved by Fomento while ADIF was in charge of its implementation. ADIF could not confirm whether the ex ante CBA of the AVE Madrid-Barcelona investment was audited.

The preparation of the business case for the project, including the ex ante CBA, largely followed the CBA technical methodologies developed by Fomento, including an Investment Manual (2000, 2009). ADIF confirmed that the 2009 version of the Investment Manual adopts the recommendations of the Commission, in particular those in DG REGIO’s 2008 CBA Guidelines. The Investment Manual also benefits from the experience gathered over recent years. For example, it includes benefit and cost parameters and unit cost estimates. ADIF mentioned that the only difference they noticed was the value of the discount rate, which has decreased to 5.5% for the economic analysis and to 5% for the financial analysis.

ADIF works with the ex ante CBA model prepared by Fomento and is in charge of reviewing the demand and cost estimates as the project gets implemented. They claimed that the updating of the financial and economic model translates into reduced uncertainty regarding demand figures and total costs. ADIF did not provide details but acknowledged that unforeseen events related to the technical complexities of the project (e.g. soil conditions or access to Barcelona Sants railway station) resulted in some differences between projected and out-turn costs and forecasts.

Finally, while ADIF could not comment on the uses of ex ante CBA by Fomento, they confirmed that, in addition to ex ante CBA, Fomento also commissions studies which use a multi-criteria methodology.
2.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

As stated the 2001 INECO ex ante cost benefit analysis considers the whole LAV Madrid – Barcelona – French border. However, because the Barcelona – French border section is not yet operational, and no data are available for it, our ex post cost benefit analysis considers the new infrastructure as being only the LAV Madrid – Barcelona segment. For this reason the two analyses are not fully comparable. Another important issue is that the ex ante results are obtained considering the 1997–2024 period for the analysis while we consider the 1997–2033 period.

Apart from the fact that the ex ante analysis and the ex post analysis do not consider exactly the same infrastructure, there exist other difference between INECO and our approach that we summarize below.

- **Traffic forecast.** RENFE provided aggregate data on traffic volume for years 2008 and 2009, and together with information modal shift information from ADIF we have estimated the number of 2008 and 2009 passengers in each segment of the new line. When comparing ex ante and ex post data it can be said that, overall, the 2001 ex ante analysis assumes higher traffic volume than the estimated for the ex post analysis in 2008 and 2009.

- **Capital costs.** Investment cost profiles are different in the ex ante and in the ex post analysis. Even though they are not directly comparable because, as mentioned above, the ex ante analysis includes the whole LAV Madrid – Barcelona – French border, ex post figures provided by ADIF are overall higher, suggesting an overspend for the entire infrastructure.

- **Consumer surplus distribution.** We have calculated the share of consumer surplus that each of vehicle operating costs, time savings, safety and environmental benefits represent, both for the ex ante and the ex post CBA. There are substantial differences between the ex ante figures and both the ex post CBA and the 2009 ADIF report. In particular, the ex ante analysis assumes that time savings are by far the largest source of benefits, while in the ex post analysis vehicle operating cost savings are the largest.

- **Inclusion of additional impacts.** The ex ante CBA includes employment generation in the social analysis. The document does not provide any further detail on how employment generation is monetised but refers to a study carried out by the Ministerio de Fomento. In accordance with the approach followed in all the ex post evaluations, we have not included employment generation benefits in our analysis.
3 A2 motorway in Poland

3.1 Project characteristics

This highway infrastructure project consisted of the construction of a two lane motorway (A2) between Konin and Strykow in central Poland. The project was implemented in two phases:

- Phase One (June 2006) – Konin to Emilia (85.8km); and
- Phase Two (July 2006) - Emilia to Strykow (18.1km).

The A2 (European Route 30) is a major east west corridor providing a strategic road connection between Berlin, Central Poland and Belarus. The new section of motorway provides the strategic connectivity previously provided by the single carriageway R72 between Konin and Strykow. The scheme passes through a Special Economic Zone (SEZ) and as such is regarded as one of the key enablers to economic growth and regeneration in this central area of Poland. The national objectives of the scheme were to ensure the effective road connections needed to support intensification of trade; improve the accessibility of vital economic urban centres; improve road safety and eliminate the social and economic costs of road accidents and support regional development.

The total aggregate cost for this project was €406m compared to the forecast cost of €401m. The total contribution made from EU Cohesion funds was approximately €325m, with the European Investment Bank contributing further funds up to the 90% maximum funding support permitted.

3.2 Ex post CBA

3.2.1 Results of analysis

The tables below show the results of the ex post economic and financial analysis for the A2 Poland Motorway. To capture the uncertainty regarding projections of future traffic growth and the associated margin of error for ex post evaluation we have assumed a low and high growth scenario. The low growth scenario assumes that traffic growth is 50% lower than forecast throughout the evaluation period, whilst the high growth scenario assumes 2-4% annual traffic growth throughout the evaluation period (same as predicted).
The ex post economic analysis presented in Table 1 shows that, for both cases, the project has delivered a very satisfactory economic IRR and BCR. The ex-post financial analysis contained in Table 2 shows that the NPV of the investment is negative which indicates that the scheme is not value for money financially. However, the NPV of capital (which excludes the EC contribution for the scheme) is positive.

### 3.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** The main source of benefits identified in the ex-post evaluation was from journey times and safety benefits. Journey time savings of 1h 15 minutes were achieved for the section between Konin and Stykow, this is substantially higher than the 50 minute saving forecast. Our traffic analysis has shown that a vast majority of the traffic now using the A2 has re-assigned from the R2 (north of the scheme) and R72 (south of the scheme). There has been an observed reduction in accidents of 10% on the main strategic routes affected by the scheme (A2; R2; R72; and R14), this compares to a forecast reduction of 13%.

### A2 motorway in Poland
Wider impacts (addresses “Costs and benefits that cannot be expressed in monetary form”). The project was implemented against a backdrop of rapid economic growth in Poland. Therefore, it is difficult to establish a causal link between the A2 project and specific impacts. Nonetheless, it is clear from our consultation with stakeholders that the project (and future proposals to extend the A2 to Warsaw and proposals for the north south A1 route) is regarded as a key enabler of economic growth in central Poland. Key benefits of the scheme identified by stakeholders include: faster and more reliable connectivity between Poland and neighbouring countries; increased Foreign Direct Investment; quality of life improvements through reduced traffic on the bypassed routes; increased land values along the corridor; supported tourism access. Adverse impacts reported include increased nuisance caused by poor noise and air quality on the existing R14 (at the eastern end of the A2 motorway).

Meeting environmental requirements. A number of ex-post evaluation studies have been undertaken to establish the effectiveness of noise mitigation measures such as noise absorbent barriers; animal crossing points; water pollution control and vegetation planting. Headline messages from these evaluations include: no measurable impact on air quality; human health; petroleum hydrocarbons; soil and water systems. Additional noise mitigation measures were recommended along sections adjacent to urban areas between Dabie and Strykow. Some disturbance to animal movements and agricultural land use was also identified.

Utilisation. The utilisation of the project since opening has been calculated by considering the ratio between the actual total number of passenger car units (PCUs) and the total potential number of PCUs that could be accommodated on the A2 (2010 figures). Calculations show that utilisation rates on the two section of A2 are between 56% and 67%, largely because of the very high HGV proportion of 50% suggesting spare capacity does exist. Future utilisation calculations show that the project would be approaching capacity in 2022 if the forecast traffic growth is realised;

Unit costs. We requested unit costs to the most disaggregated level, but neither the out-turn or forecast costs were consistent with the Level 2 and 3 cost descriptions prescribed in Work Package 10. The evaluation team did make enquiries with GDDKiA and the EIB to obtain a more detailed set of cost figures but we were referred back to the original application forms and the Project Completion Report for definitive costs. As such our analysis shows that on a cost per km basis land purchase costs were around 67% higher than forecast. The Level 1 unit cost was as predicted at €3.9m per km.
**Main project risks and consequences.** Project risks were identified at the time of the ex-ante analysis and sensitivity tests were largely focussed on assessing economic impacts based on traffic flow and cost uncertainties. Observed traffic levels for the A2 itself were within 20% of forecast and the reductions in traffic flows on the R2 (the old A2) have been much greater than forecast hence the extent of the ex-ante sensitivity test seems appropriate.

**Accompanying actions** (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). We would envisage that the dramatic increase in capacity is likely to have been sufficient to promote the success of the scheme in its own right. The improved A2 itself has been used as a key selling point for those involved in promoting economic development along the route e.g. Stykow, Lowicz, Lodz and Konin.

**Unintended effects.** The nature of the positive impacts observed following project opening are largely as desired and on the whole adverse unintended effects have largely been avoided. Anecdotal evidence from stakeholders suggests that increased traffic on the R14 between the improved section of the A2 and Warsaw has had adverse impacts on noise, air quality and road safety. Furthermore maintenance challenges on the R14 and other links to the A2 have emerged as a result of greater presence of HGVs in the vicinity of the scheme. Furthermore public awareness of proposals for development of Poland’s motorway network has lead to land values rising more than expected – hence the higher than expected land costs associated with this scheme.

### 3.3 Ex ante CBA

#### 3.3.1 Results of analysis

As illustrated in the following table, the scheme was expected to perform strongly in economic terms. A financial analysis was not undertaken at the time of the ex-ante appraisal on the basis that the scheme was not designed to be a toll motorway. In our view this represents an important omission from the ex-ante appraisal that should have been considered. Construction of toll booths along the A2 is currently being underway, once open these will clearly have a detrimental impact on the economic results of the project whilst potentially improving the financial case for the scheme through revenue generation.
Table 9. Results of ex ante cost benefit analysis – A2 Poland

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 2003 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>1,867</td>
<td>20.2%</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Source: Application for EU Assistance (March 2003)

3.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** (addresses "Validity of assumptions made during the ex ante analysis"). The CBA presented at the time of the ex-ante appraisal was complete and broadly consistent with CBA guidance expectations at the time of preparation. However we identified a number of issues for consideration:
  - The CBA does not clarify why the alignment was selected in preference to other route options;
  - The CBA did not include analysis of potential induced traffic and fuel duty impacts from the scheme;
  - The forecast benefits seem to be much higher than would usually be expected for a project of this kind (excess of €11bn);
  - There was not formalised evidence of detailed risk assessment being undertaken, however a small number of sensitivity tests were prepared;
  - There was no single self contained CBA document for the entire project which was funded through 3 separate cohesion fund applications. A standalone document which explicitly details the process; assumptions and CBA results is strongly recommended; and
  - At the time of writing there is recognition that the quality of CBA in Poland is improving through greater experience of best practice disseminated through EU application procedures.

- **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). No standalone risk assessment analysis was prepared for this project at the ex-ante stage, however a number of sensitivity tests were undertaken to demonstrate the robustness of forecast economic benefits from the A2 project. The tests were presented of traffic flows and scheme costs being +/- 20% different to the central case scenario. Results showed that the despite the variations in costs and traffic flows, the project was still
projected to perform well in IRR terms. The IRR showed less variation in response to cost changes compared to traffic flow changes, but nevertheless results were sufficiently robust to show that the scheme was still likely to stack up in economic terms irrespective of the inflated/deflated traffic flows. These rigour of these results were further substantiated by the EIB’s own risk assessment which gave them the confidence to invest in the scheme.

3.3.3 Role of ex ante CBA

The depth of ex ante evaluation for the A2 project was largely dictated by the processes and requirements set out by the EU guidelines in “Guide to Cost Benefit Analysis of Major Projects in the Context of EC Regional Policy” (June 1997) at the time of application.

It was generally felt that CBA guidance is useful and gives sufficient flexibility for Member States to adopt aspects of their own CBA processes to meet the challenges posed by different types of transport project. This does however create some problems in that consultants regularly misunderstand the importance of documenting their CBA assumptions clearly as part of the overall application process.

Overall, the rigour of CBA auditing for Polish funding applications has improved over recent years. Internally within Poland, all applications for cohesion funding under the 2007-2013 have been subjected to a greater degree of auditing than was the case for the A2 Konin to Strykow under the previous ISPA and 2000-2006 cohesion funding processes. An illustration of improvements to CBA auditing procedures is the establishment of CUPT in 2007. The mission of this body is to support beneficiaries such as GDDKiA in the preparation for and implementation of EU funded projects including those funded through the EU Cohesion Fund. As a major investor in the A2 Konin to Strykow project and of other major transport projects implemented in new Member States, the EIB undertook its own CBA analysis using its own models based on more conservative values of time, accidents and vehicle operating costs.

Discussions held with the relevant stakeholders have revealed that CBA was not used as a tool to prioritise between alignments for this pilot project as the alignment had been set many years before EU accession. Our discussions revealed that Poland has a national priority to build up its motorway network, only after this has been achieved will CBA be more comprehensively used to prioritise projects or options. Furthermore there was a general consensus that it was political influence determining which projects progress and not the outcome from CBA which at most confirms the extent to which a chosen project offers value for money. There was also a view that Member States regard CBA as a hurdle to jump in order to secure funding and the “go versus no go” scenario rarely exists.

A2 motorway in Poland
3.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

- **Discount rates.** The ex-ante appraisal assumes a discount rate of 8% compared to 5.5% used in the ex-post evaluation. As such the ex-post evaluation gives higher benefits than would be reported through the application of an 8% discount factor. Our analysis has shown the use of an 8% factor would give a BCR more comparable to that forecast.

- **Capital Costs.** The ex-post evaluation shows that investment costs were higher than expected; this can be attributed to extra land acquisitions; delays in construction due to poor weather conditions; additional drainage, earthworks and safety costs; increased land costs and devaluation of the Euro.

- **Additional Impacts.** Traffic volumes on the A2 were higher than forecast and there was greater than expected re-assignment from the R2 to A2. Furthermore induced traffic was not considered in the ex-ante appraisal.

- **Different parameters.** For the ex post CBA we have used updated values for all the parameters used to calculate the benefits of the project, ranging from the value of time, the reduction of vehicle operating costs and updated accident costs. These are generally higher values than those used in the original CBA (even when compared at the same price base) and hence the application of this change has increased the benefits.

- **Modelled Speeds.** We had to change the modelled speeds used in future years significantly in the ex-post evaluation. The CBA assumes that traffic growth on Road 2 would cause journey speeds to deteriorate very quickly, and speeds of 10km/h are shown for 2009, and all subsequent years. In our view, this is unrealistic and we have increased these speeds to incorporate a more sensible cut-off in line with best practice.
4 Algarve railway in Portugal

4.1 Project characteristics

The Lisbon – Algarve railway project covers a significant part of the overall modernisation of the Algarve railway line (covering the Linha do Sul and Linha do Algarve). The part included in the current study covers the segment from Coïna (near Lisbon) to Faro, including a branch to Porto de Sines. The project is part of the TEN-T Priority Project 8 (Multimodal Axis Portugal/Spain – Rest of Europe).

The total aggregate value for the project was €419,026,183, while the total amount eligible for funding was €405,043,302 or 96 per cent of the total. The total Cohesion Fund contribution in the period 2000-2006 was €323,486,946, equal to about 80% of the eligible project costs.

The project involved, among other works, the duplication of the track in some sections of the line, the electrification of parts of the line which were previously non-electrified, the construction of various new stations, and the installation of a new automatic control system to increase maximum speed in various sections of the line.

The Algarve railway contributes to the development in Portugal of a service platform that articulates the long-run transport between Europe on one side and America and Africa on the other side. This is one of the objectives stated by the Portuguese government in its transport policy strategy for the period 2000-2006.

4.2 Ex post CBA

4.2.1 Results of analysis

Two alternative scenarios were identified, a pessimistic one (low case) and an optimistic one (high case), which define a range of possible outcomes for the ex post CBA. To define the pessimistic scenario (Low case), we have considered the low outcome for benefits (driven by traffic volume). We have used the opposite assumption (i.e. high outcome for benefits) to define the optimistic scenario (High case).

The table below summarises the results of the ex post analysis for each scenario.
Table 10. Summary of ex post economic analysis (2008 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Present Value (€m)</strong></td>
<td>48.2</td>
<td>79.2</td>
</tr>
<tr>
<td><strong>Economic IRR (%)</strong></td>
<td>6.7%</td>
<td>7.5%</td>
</tr>
<tr>
<td><strong>Benefit-cost ratio</strong></td>
<td>1.15</td>
<td>1.24</td>
</tr>
</tbody>
</table>

Source: Own calculation

A financial analysis was also carried out for the ‘Low case’ and ‘High case’ scenarios. For each scenario, the Financial Net Present Value and Financial Rate of Return, for both the investment – FNPV(C) and FRR(C) – and the capital employed – FNPV(K) and FRR (K) – were calculated.

The table below summarises the results of the financial analysis for each scenario. The analysis shows that, under each scenario, the project is not ‘revenue-generating’ as the net present value of the costs over the assessment period exceeds the value of revenues.

Table 11. Summary of ex post financial analysis (2008 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Present Value – Investment (€m)</strong></td>
<td>-299.03</td>
<td>-298.96</td>
</tr>
<tr>
<td><strong>Financial IRR – Investment (%)</strong></td>
<td>-3.6%</td>
<td>-3.6%</td>
</tr>
<tr>
<td><strong>Net Present Value – Capital (€m)</strong></td>
<td>-111.2</td>
<td>-111.1</td>
</tr>
<tr>
<td><strong>Financial IRR – Capital (%)</strong></td>
<td>0.17%</td>
<td>0.17%</td>
</tr>
</tbody>
</table>

Source: Own calculation

4.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** As this project involved the upgrading of an existing railway line, rather than the construction of a new route, most of its benefits actually come from time and maintenance savings, as well as from positive externalities such as the reduction in noise, pollution, accidents and climate change effects.

- **Wider impacts** (*addresses “Costs and benefits that cannot be expressed in monetary form”). The lack of any form of impact monitoring since the opening, makes
identifying a causal link between the project and any wider effect very problematic. In this kind of situations, it is difficult to separate the impacts of the project from the impact of other ongoing changes in the economy.

Nonetheless, there is some evidence that per capita income might have improved in the regions connected by the railway line. It is however problematic to attribute these changes just to this project.

Following the Algarve railway project three additional routes are being considered: Lisbon – Porto, Porto – Vigo (Spain), and Lisbon – Madrid. The latter will use part of the Lisbon – Algarve railway track, specifically the Lisbon – Évora section.

- **Meeting environmental requirements.** REFER provided a list of studies related with environmental impact of the railway. All studies were undertaken either during construction or immediately after opening. According to these studies, there were no significant actions to undertake, apart from those already anticipated to mitigate any environmental impact during construction or afterwards. The only additional action was the implementation of a noise barrier in Funcheira, according to legal requirements.

- **Utilisation.** We have calculated this by considering, for each year, the ratio between the actual total number of passengers and the total potential number of passengers that could have travelled on the line given the installed capacity. Due to lack of appropriate data we consider only long distance trains (‘longo curso’). Based on our calculation, we have found that utilisation rates, on long distance trains only, ranges between 58% and 63%, with an average of about 61%. However, we note that, due the assumptions underpinning this calculation and the fact that it considers only one type of train service, this result should be treated as indicative.

- **Unit costs.** Information received from REFER allowed us calculate disaggregated cost information by components and to provide unit costs for the various components down to Level 1 and Level 2. Overall, the project cost about €1.3m per km, in NPV terms. The full case study provides the detailed list of unit costs.

- **Main project risks and consequences.** The key risks for the project were already identified at the time of the ex ante analysis. We did not identify any additional risks envisaged, except for a possible unexpected fall in demand, arising, for example, from competing modes such as air and air travel. This would have the effect of slightly decreasing the projects’ economic and financial returns.
• **Accompanying actions** *(addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”).* Several marketing campaigns and passenger services were released to encourage travellers to use the train and therefore enhanced the project success. These included: selling tickets through travel agencies, vending machines, internet, cash machines, and mobile phones, internet connexion on trains, differentiated rates for group travellers and firms, park-and-ride special fees, special agreements with hotels and rental car companies, assistance for travellers with special needs, additional trains for special events (Euro 2004, music festivals, festivities, Red Bull racing, etc.) and during peak periods (weekends, summer, etc.), marketing campaigns through the press, radio, leaflets and advertising posts.

• **Unintended effects.** According to stakeholders, the success of the project may have been limited by the capacity on the “25 de April” bridge for medium and long distance trains in and out of Lisbon. Because of this constraint, according to REFER, journey times to Setúbal, Évora, Beja and Faro are normally higher than for road transport.

### 4.3 Ex ante CBA

#### 4.3.1 Results of analysis

The first assessments of this project were carried in 1996 and 1997. These were mainly financial assessments and did not include an economic CBA. In 1999 REFER extended these studies by preparing an ex ante CBA of the main implementation options. This study was later updated in 2000 with the inclusion of freight benefits that REFER omitted in the previous analysis.

Given that it was not possible to extract an ex ante CBA for the Coina-Pinhal Novo section, ex ante CBA results correspond to the route between Pinhal Novo and Faro.
Table 12. Results of ex ante cost benefit analysis – updated in 2000

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Option MAX</td>
<td>23,252</td>
<td>156.7</td>
<td>9.1%</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Source: REFER, Modernização da ligação ao Algarve, Estudio Económico-Financeiro (Actualização), November 2000

4.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** (addresses “Validity of assumptions made during the ex ante analysis”). Overall, the ex ante analysis we have reviewed (both the original 1997 analysis and the subsequent 2000) appears to be complete in its core parts. The methodology used takes into account a variety of different impacts, including several externalities such as noise, pollution and congestion. This is not common for the projects we have reviewed in this evaluation. Despite the completeness of the core analysis, we found the approach used lacking in two aspects, specifically:

  - the reports accompanying the ex ante applications are often too concise and somewhat cryptic, making the reconstruction of the analysis very difficult;
  - the analysis does not consider a variety of different options, particularly in its latest iteration, where only one option (Option MAX) is actually analysed.

- **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). The 1997 study presents a very high level overview of the reference base case and of four alternative implementation scenarios. For each option, it provides a brief description of what type of works it entails, an indication of the type of rolling stock that would be used, its freight capacity and the estimated journey time. No further details are given. After providing this brief overview, two of these four scenarios are selected as the alternative implementation options. From this point onwards, these options, labelled option MAX, involving more significant works on the line, and option MIN, involving smaller interventions, are the only two alternatives that the CBA considers.
4.3.3 Role of ex ante CBA

REFER told us that, at the time of the initial project design (the late 1990s), they did not use the ex ante CBA to inform decisions concerning which projects to implement and, within each project, which construction options to choose. At that time, the motivation underpinning investment decisions did not originate from economic analysis. Rather, they were driven by overall policy objectives. For this specific pilot project, the ex ante CBA was carried out mainly to comply with EU requirements for funding applications, but not to inform the decision making process.

However, REFER also told us that their internal procedures are now significantly different. Currently, REFER carries out a detailed ex ante CBA for each project under consideration. The CBA is used not only to decide which overall project should be prioritised, but also to choose between alternative implementation options.

4.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

- **Traffic forecast.** There is a substantial difference between the ex ante and ex post analyses in the number of passengers in the first ten years of the project assessment period. The ex ante analysis assumes that the line would be re-opened to traffic already from 2000 but it was re-opened in 2003. Also, the ex ante CBA assumed that at the time of re-opening, total traffic would already be at about 80% of the long run level and it would reach that level in about four years but initially traffic was lower than estimated in the ex ante analysis. However we have noticed a faster growth rate, leading to traffic reaching a level very close to the ex ante steady state by 2009.

- **Application of ‘rule of half’.** We have used the ‘rule of half’ for the calculation of the benefits from time savings. Based on the calculations for the ex ante analysis, REFER did not apply the ‘rule of half’. This has potentially led to an over-estimation of the project’s benefits in the ex ante analysis. Accordingly, we have applied the ‘rule of half’ in the ex post CBA. This has had the effect decreasing the value of benefits, if compared with the ex ante analysis.

- **Capital costs.** Capital costs are one of the main differences between the ex ante analysis and the ex post evaluation of the project. The nature of this difference relates to the time when the capital costs were incurred and the total amount of capital expenditures.
In the ex ante analysis, REFER assumes that capital cost would be incurred in the first three years of the assessment period (1997 - 1999). However, the ex post historic data shows that, while REFER started incurring costs in 1997, the bulk of the capital expenditure costs took place between 2001 and 2005.

- **Different parameters.** For the ex post CBA we have used updated values for all the parameters used to calculate the benefits of the project, ranging from the value of time to the reduction of vehicle operating costs and pollution thanks to modal shift. These updated values are those that REFER currently uses. In addition, REFER has now introduced a value to estimate the benefit from the reduction in road congestion, which was not available at the time of the ex ante analysis. The use of these updated values in the ex post analysis has had the effect of increasing the value of benefits, if compared with the ex ante analysis.

- **Discount rate.** In the ex ante analysis, REFER calculated the NPV of the project using a 5% discount rate, as suggested by the guidance available at the time. Currently, the EC Guide on Investment Appraisal recommends using a 5.5% discount rate.

- **Inclusion of additional impacts.** The ex ante CBA does not include two elements that we believe should be included in analysis: *Total revenues* (in the ex post CBA we have considered CP's revenues) and *Foregone government revenues from the fuel tax.* (modal shift from road to rail implies a reduction in overall fuel consumption, which, in turn, implies lower government revenues from the fuel tax).
5 **A23 motorway in Spain**

5.1 **Project characteristics**

The A23 motorway in Spain (also called Autovía Mudéjar) is a high capacity road connecting Sagunto, on the Mediterranean coast just north of Valencia, and the Somport road tunnel. The tunnel connects Spain and France through the central Pyrenees. It was opened in 2003. Although the A23 is not part of any TEN-T corridor, it belongs to the European route E07 connecting Pau in France to Zaragoza in Spain. Currently, the A23 motorway is completed between Sagunto and Nueno. The remaining sections between Nueno and the Somport tunnel are either under construction or in advanced planning stages. At this point, it is unclear when the A23 motorway will be completed. Recent budget cuts announced by the Spanish government in July 2010 are likely to cause delays.

The project under analysis comprises four subprojects, namely one 11.5 km-long segment between Huesca and Nueno, and three adjacent segments between Teruel Norte and Calamocha, for a total of 63.5 km. The two sections are 178 km apart. The total aggregate value for the project was around €205 millions and the total Cohesion Fund contribution in the period 2000-2006 accounted for 85% of the eligible project costs.

All four segments are located in Aragon, in north-east Spain, bordering with France to the north, in the Pyrenees. The capital city of Aragón is Zaragoza, the fifth largest Spanish city. Aragón has three provinces: Zaragoza, Huesca and Teruel. The A23 sections considered in this analysis are located in the provinces of Huesca and Teruel. Both provinces cover a total extension of 30,000 km² (about the size of Belgium) and have a total population of 370,000 people.

5.2 **Ex post CBA**

5.2.1 **Results of analysis**

To carry out the ex post CBA for each of the four subprojects we have considered a Low Case and a High Case. These scenarios use different assumptions regarding the traffic growth on the four segments after 2008. The High Case (optimistic scenario) assumes a constant traffic growth rate, equal to the average of the long-run traffic growth on the four segments. This is about 5% per year. The Low Case (pessimistic scenario) assumes a constant 2.5% traffic growth rate after 2008.

We have calculated single economic indicators (NPV, IRR and BCR) covering all the four subprojects under study.
Table 13. Summary of ex post economic analysis (2010 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m)</td>
<td>-27.7</td>
<td>27.6</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>4.6%</td>
<td>6.3%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>0.9</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Source: Own calculation

The Funding Applications did not include any financial analysis for any of the four subprojects under study. This is because the A23 is a toll free motorway and therefore has no revenues.

Nonetheless, we have done an ex post financial analysis for the whole project, calculating the annual cash flow. The table below summarises the results of the ex post financial analysis. Low Case and High Case yield the same financial NPVs because capital and maintenance costs are not traffic-related.

Table 14. Summary of ex post financial analysis (2010 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low / High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value – Investment (€m)</td>
<td>-230</td>
</tr>
<tr>
<td>Financial IRR – Investment (%)</td>
<td>Not available</td>
</tr>
<tr>
<td>Net Present Value – Capital (€m)</td>
<td>-55</td>
</tr>
<tr>
<td>Financial IRR – Capital (%)</td>
<td>Not available</td>
</tr>
</tbody>
</table>

Source: Own calculation

5.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** Most of the benefits of the project come from time savings and improvement in safety conditions. On the other hand, the new road implied higher vehicle operating costs and higher fuel consumption.

- **Wider impacts** (*addresses “Costs and benefits that cannot be expressed in monetary form”*). We note that the subprojects under analysis in this evaluation are relatively minor compared to the whole of the A23. It is therefore difficult to establish causality links between these investments and any wider impact. Moreover, the A23 is one of the many interventions that affected the region.
during the same period. However, for the purpose of this evaluation, we managed to isolate the impacts that are more specific to the segments considered.

In relation to the three subprojects located in the province of Teruel, we obtained information about two new infrastructure projects (an industrial park and an airport) developed in the area since the opening of the first road segments. In relation to the subproject Huesca – Nuén, new infrastructures (an industrial park, a technology centre, and new university buildings) have been developed along the A23 near Huesca since the opening of the new road.

- **Meeting environmental requirements.** The environmental impacts of the LAV Madrid – Barcelona were taken into account in the cost-benefit analysis, using marginal cost parameters defined by Ministerio de Fomento. The parameters cover the following main impacts: noise, pollution, climate change (CO2 emissions), nature and landscape and impacts on the urban environment (such as congestion).

- **Utilisation.** With information provided by the Ministerio de Fomento about the maximum capacity of the new road, we have calculated that utilisation rates in 2008 ranged from 4.8% to 5% depending on the section considered. Expected utilisation rates in 2036 were also calculated. For the high case, they would range from 18.8% to 19.6%, and for the low case, from 9.6% to 10%.

- **Unit costs.** The Ministerio de Fomento provided us with disaggregated cost information (Level 2) regarding the subprojects Huesca (N) to Nuén and for the project Teruel – Santa Eulalia. Data disaggregated at Level 3 is not available.

- **Main project risks and consequences.** The ex post analysis does not consider the possible network effects that the construction of the Somport tunnel will have on the whole traffic demand, especially for the Huesca – Nuén segment. The reason for this is that it is not expected to be finalized in the near future.

- **Accompanying actions** (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). With the exception of information campaigns (on national newspapers, radio, television and websites) no other action to enhance the project success was undertaken.

- **Unintended effects.** The ex ante cost-benefit analysis assumed that, after opening the A23, the old road would only carry residual traffic (tráfico de agitación). In reality, the N-234 in Teruel and the N-330 in Huesca still carry
a significant volume of traffic, currently between 2,000 and 2,500 vehicles a day.

5.3 Ex ante CBA

5.3.1 Results of analysis

The ex ante CBAs prepared by Ministerio de Fomento, and used to prepare the four applications for funding, considered just the option implemented. They assessed it against the counterfactual of the old road being maintained.

The table below shows the economic indicators for each of the four subprojects included in the analysis, together with the underlying assumptions regarding the base year and discount rate used in the calculations.

**Table 15. Results of ex ante cost benefit analysis**

<table>
<thead>
<tr>
<th>Subproject</th>
<th>Discount rate</th>
<th>Base year</th>
<th>Net Present Value (€ million)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Huesca to Nueno</td>
<td>6%</td>
<td>1998</td>
<td>2.60</td>
<td>7.05</td>
<td>1.12</td>
</tr>
<tr>
<td>Monreal del Campo to Calamocha</td>
<td>6%</td>
<td>1999</td>
<td>15.98</td>
<td>9.45</td>
<td>1.51</td>
</tr>
<tr>
<td>Santa Eulalia del Campo to Monreal del Campo</td>
<td>6%</td>
<td>1999</td>
<td>1.57</td>
<td>6.15</td>
<td>1.02</td>
</tr>
<tr>
<td>Teruel(N) to Santa Eulalia del Campo</td>
<td>5%</td>
<td>2002</td>
<td>90.80</td>
<td>16.65</td>
<td>2.93</td>
</tr>
</tbody>
</table>

Source: Ministerio de Fomento

We have re-calculated these economic indicators using common assumptions regarding the base year and the discount rate. By doing so, we have been able to calculate a unique NPV, IRR and BCR covering all four subprojects under study. We have assumed a discount rate equal to 5.5% (as used in the ex post CBA) and used 1998 as base year.
Table 16. Results of ex ante cost benefit analysis – Revision

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 1998 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole project</td>
<td>86.54</td>
<td>9.14</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Source: Frontier Economics using data from Ministerio de Fomento

The A23 motorway is a toll free road. The applications for funding submitted in 1999 and 2003 do not include any financial analysis for any of the subprojects under study.

5.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** (addresses “Validity of assumptions made during the ex ante analysis”). Overall, the quality of the ex ante Cost Benefit Analysis of the four subprojects is high. We have found that all of them follow a well established methodology proposed by the Ministerio de Fomento. The ex ante CBAs clearly stated the parameters used and their source and sensitivity analysis is included. On the other hand, the main drawback of the ex ante CBAs of the four subprojects is referred to demand forecast. It is not clearly stated how future traffic growth is calculated. Also, the assumption that the new infrastructure would not generate induced traffic is questionable.

- **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). A sensitivity analysis was carried out in each of the four ex ante CBAs. In all cases two scenarios were tested, regarding the assumed traffic growth and the value of time. Scenario 1 assumes a lower traffic growth rate in each of the four subprojects. In Scenario 2, the value of time for cars and LGVs was reduced in order to induce a 20% reduction in the series of net benefits.

5.3.3 Role of ex ante CBA

We have talked with Ministerio de Fomento - Unidad de Carreteras de la Demarcación de Aragón regarding the role of CBA in the decision making process. We have received confirmation that the decision to construct the A23 was mainly political. Despite this, the decision among different alternatives regarding the exact configuration of the road was based on two economic analyses undertaken by the Demarcación de Carreteras del Estado en Aragón.
5.4 Comparison of ex ante and ex post CBA

There main differences between the two analyses stem from the following areas:

- **Value of time and fuel.** Ex post information shows that fuel cost parameters have increase by more than 100% since the ex ante analysis was carried out. In contrast, the value of time has increased by approximately 50%. Time savings and fuel costs are the main drivers of the net economic benefits induced by the project. The significant decrease of the economic indicators in the ex post analysis is mainly the result of the change in relative values of these two parameter sets.

- **Time savings.** The ex ante analysis forecast a total amount of time savings along the four segments considered equal to 27 and 33 minutes for cars/LGVs and HGVs respectively. In the ex post analysis, and according to the speed data obtained from the Ministerio de Fomento, actual time savings achieved through the four segments are 13 and 9.3 minutes, significantly lower that what was originally assumed.

- **Traffic volume.** The ex ante analysis forecast that traffic growth on the new A23 would be around 3% annually. Historic traffic data shows that the long-run annual growth rate of traffic has been around 5%. This 5% has been used as the traffic growth rate after 2010 in the optimistic scenario of the ex post analysis.

- **Safety conditions.** Information provided by the Ministerio de Fomento used in the ex post CBA suggests that safety condition were undervalued in the ex ante analysis. The average reduction of fatalities and injuries per km in the ex ante analysis was 53% and 13% respectively. Ex post information considers an average reduction of 100% and 83% respectively.

A23 motorway in Spain
6 Agiou Konstantinou bypass in Greece

6.1 Project characteristics

The dual carriageway Agiou Konstantinou Bypass opened to traffic in October 2008 forms part of a wider package of improvements (most which have already been implemented) to modernise the PATHE (Patras, Athens, Thessaloniki, Evzoní) transport axis. This corridor also forms the European E75 route which is part of the TEN-T Priority Motorway Axis 7 from Igoumenister to Budapest. The strategic objectives of the improved route which bypasses a previously congested single carriageway route through the coastal towns of Kamena Vourla and Agiou Konstantinou Bypass were to: improve average speeds and journey times in general, road safety; improve highway connections between Greece and other parts of the EU and reduce load to capacity ratio to raise the level of service to standards achieved on strategic routes elsewhere in the EU and improve economic competitiveness in Greece through reduced journey times.

The total aggregate cost for this project was €317.8m, of which €117m (37%) was funded through EU Cohesion Funds. The out-turn cost was €40m higher than forecast, the reasons for these cost over-runs are explained later in this summary.

6.2 Ex post CBA

6.2.1 Results of analysis

There are clearly many uncertainties associated with the forecasting of long term traffic impacts of large scale projects such as the Agiou Konstantinos bypass. Although the ex post evaluation uses observed data from before and after project opening, there are still many years remaining within the appraisal period for which to estimate future growth. We have therefore presented a low and high growth scenario based on the assumptions presented in the table below.
The following tables show the results of the ex post financial and economic analysis for the Agiou Konstantinos Bypass.

**Table 17. Summary of ex post High and Low Growth Assumptions—Agiou Konstantinos**

<table>
<thead>
<tr>
<th>Year Range</th>
<th>Ex Ante</th>
<th>Ex Post</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LOW CASE</td>
<td>HIGH CASE</td>
</tr>
<tr>
<td>2008-2012</td>
<td>3%</td>
<td>0%</td>
</tr>
<tr>
<td>2013-2019</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>2020-2025</td>
<td>3%</td>
<td>1.5%</td>
</tr>
<tr>
<td>2026-2031</td>
<td>3%</td>
<td>0.75%</td>
</tr>
</tbody>
</table>

Source: Own calculation

The economic analysis shows that, for both cases, the project has delivered a very satisfactory IRR and BCR.

**Table 18. Summary of ex post economic analysis (2000 prices) – Agiou Konstantinos**

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m @ 5%)</td>
<td>233.0</td>
<td>283.0</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>12.6%</td>
<td>13.4%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>2.1</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Source: Own calculation

The economic analysis shows that, for both cases, the project has delivered a very satisfactory IRR and BCR.
The ex-post financial analysis shows that from a financial perspective the scheme performs poorly. This is consistent with the results published in the ex-ante evaluation and can be attributed to the high investment cost associated with the complex structures required to overcome the difficult topographical conditions through which the scheme passes. The lower than expected traffic volumes will have also adversely impacted on revenues further reducing the attractiveness of the scheme.

### Key aspects of the ex post evaluation

- **Sources of benefits.** The main source of benefits identified in the ex-post evaluation was from journey times and safety benefits. Journey time savings of 9mins and 13mins have been achieved for the old and new road respectively, this is marginally higher than those forecast in the CBA. The saving is partially attributable to speed violations not considered in the ex-ante CBA. A small reduction in accidents has been observed following scheme opening. Although representing a small proportion of the overall monetary benefit, toll revenues have been generated from the scheme, despite the slightly lower than forecast traffic volumes.

- **Wider impacts** (*addresses “Costs and benefits that cannot be expressed in monetary form”). The project was implemented against a backdrop of rapid economic growth in Greece. Therefore, it is difficult to establish a causal link between the bypass and other wider impacts. That said, stakeholders felt that the scheme had helped unlock the following benefits: removal of traffic from bypassed settlements to enable urban re-modelling; facilitate drainage works to address historical flooding issues; improved air quality and noise conditions; and enhanced ferry port access. Collectively such impacts are helping Agiou Konstantinos to develop as a tourist location.
Meeting environmental requirements. The Greek planning process requires a comprehensive assessment of the environmental impacts of major investment proposals, prior to the issuing of an environmental permit. An Environmental Impact Assessment (EIA) was prepared in 2001, but we could not obtain it for this study. However, we are aware that the EIA covered the extent of the project works and facilitated the approval of the Environmental Permit and the EC Application for Funding document. The project does not pass through or near to any internationally important sites (Natura 2000), and potential environmental impacts were mitigated where required (noise barriers and animal crossings). However, the project did have an impact on the local spring water, but this was successfully managed by the mitigation measures proposed. Indeed the successful management of the potential hydrology issues was raised by the Mayor of Agiou Konstantinos.

Utilisation. Based on our calculation, we have found that utilisation rates on the bypass are around 23%. However, we note that, due to the assumptions underpinning this calculation, this result should be treated as purely indicative and only represents a snapshot of the current situation. Further analysis shows that the section of route will be approaching 50% capacity by 2030 assuming forecast trends of traffic growth materialise.

Unit costs. We requested unit costs to the most disaggregated level, but neither the out-turn or forecast costs were consistent with the Level 2 and 3 cost descriptions prescribed in Work Package 10. The ex post unit cost per kilometre was €15.658m.

Main project risks and consequences. A detailed risk assessment was not undertaken at the ex-ante stage of this project. However, a number of sensitivity tests were included in the ex-ante CBA documents to demonstrate the robustness of economic benefits of the project. Tests were undertaken using varying discount rates and cost increases/decreases. The ex-post evaluation shows that the actual BCR achieved is below the range put forward in the forecasts, but this is likely to be more a consequence of inaccurate traffic flows rather than cost or discounting errors.

Accompanying actions (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). This project is part of a wider corridor improvement between Athens and Thassaloniki, and this scheme represents a small section in this overall corridor, hence one of the key objectives was regional development. More locally, the outcome of our evaluation indicates that the scheme has now enabled the local planning authority in Agiou Konstantinos to introduce enhanced parking management; sea front catering facilities; access to cultural and historical
monuments; and pedestrian environment. These urban planning measures have been undertaken independently to the scheme.

- **Unintended effects.** With the exception of traffic levels on the new road being lower than forecast, the nature of the impacts identified in the ex-post evaluation were broadly in line with expectations and stakeholders were unable to elaborate on any additional unintended impacts.

### 6.3 Ex ante CBA

#### 6.3.1 Results of analysis

As illustrated in Table 4 and 5, the scheme was expected to perform strongly in economic terms, but less favourable in financial terms. The negative financial IRR is likely to be mainly attributable to the foreseen high investment costs, suggesting that the case for the project had been built around a strong overall economic performance where journey time, safety and economic benefits are all captured.

**Table 20. Results of ex ante economic analysis – Agiou Konstantinos**

<table>
<thead>
<tr>
<th>Net Present Value (€ million, 2000 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>422.1</td>
<td>17.6%</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Source: Ex Ante CBA

**Table 21. Results of ex ante financial analysis – Agiou Konstantinos**

<table>
<thead>
<tr>
<th>Net Present Value (€ million, 2000 prices)</th>
<th>Economic IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>-154.0</td>
</tr>
<tr>
<td></td>
<td>-0.7</td>
</tr>
</tbody>
</table>

#### 6.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** (addresses “Validity of assumptions made during the ex ante analysis”). The CBA presented at the time of the ex-ante appraisal was complete and broadly consistent with CBA guidance expectations at the time of preparation. Adequate attention also seems to have been paid to environment requirements such as preparation of the EIA. However we identified a number of issues for further consideration:
  - The CBA does not clarify why the alignment was selected in preference to other route options;
• There was no evidence of detailed risk assessment being undertaken, however a small number of sensitivity tests were prepared. These should have included more rigorous testing with regards traffic demand forecasts;

• Assumptions underpinning the monetary benefits emerging from safety benefits were not clearly evident in the CBA;

• No assessment of the monetary impacts of externalities such as noise, CO2 and air quality was included in the CBA; and

• The CBA was conducted on the assumption that revenues would contribute towards the national treasury and the not the concessionaire, this will have increased the investment attractiveness of the scheme at the ex-ante stage.

**Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). Sensitivity tests were undertaken using varying discount rates and cost increases/decreases but did not consider the effect of traffic forecasting inaccuracies. Even on the basis of the riskiest options, the scheme demonstrated a good BCR exceeding 2. The ex-post evaluation shows that the actual BCR achieved is below the range put forward in the forecasts, but this is likely to be more a consequence of inaccurate traffic flows rather than cost or discounting errors. Traffic flow variance was not considered as part of the sensitivity testing.

### 6.3.3 Role of ex ante CBA

In order to ascertain the role of ex-ante CBA with regard the Agiou Konstantinos bypass a workshop was held with representatives from the Greek Ministry of Economy and Public Works and other key stakeholders. A summary of the main points raised is provided below.

- The CBA was recognised as being both a necessary procedure to complete the funding application and a useful tool for prioritising options within projects where alternative options can be tested. It was noted that a CBA is normally not prepared for smaller local projects.

- In the case of both the Agiou Konstantinos Bypass and the Thriasio to Korinthos railway, the CBA was not used as a tool to compare alternative options. For the bypass in particular, there was little potential for alternative route options due to the difficult topography in the area.

- The CBA process has not been used to prioritise between different projects (e.g. the Agiou Konstantinos Bypass as opposed to the Thriasio to Korinthos railway). Decisions at this level had been based on the

**Agiou Konstantinou bypass in Greece**
requirements for improving the priority axes and the total funding allocated to Greece.

- The CBA is considered a useful process because it provides estimations of the main impacts. However, it is considered limited because CBA struggles to capture the potential for regional benefits which take time to materialise.

### 6.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the lower than expected monetised benefits observed from this scheme.

- **Discount Rate Assumptions.** A discount rate of 5% was used in the ex-ante economic analysis compared with 5% (in accordance with the EC’s Guide to CBA of Investment Projects). For the financial analysis, the ex-ante evaluation assumed a discount rate of 7%, this is higher than the 5% used in the ex-post evaluation.

- **Peak Season Benefits.** Our ex-post evaluation does not capture the benefits of the scheme in the height of the summer season and therefore potentially represents an under estimate of the true scheme benefits.

- **Underestimation of the Investment Costs.** Investment costs were underestimated by €40m. These underestimates at the ex-ante stage can be attributed to higher than expected expropriation costs; additional costs associated with tunnel safety measures; additional waste soil transportation costs; stabilisation works and delays caused by archaeological findings.

- **Reassignment and Traffic Growth Assumptions.** In proportional terms, more traffic than expected transferred from the old road onto the new bypass, however total traffic volumes on the new road were lower than expected. The latter is likely to be attributable to adverse economic conditions prevailing at the time of the evaluation.

- **Maintenance Cost Impacts.** Current guidance recommends that maintenance cost benefits are included only in the financial analysis of proposed infrastructure projects, therefore our ex-post estimate of scheme economic benefits should be regarded as conservative. The ex-ante CBA incorporates maintenance costs into both the economic and financial analysis.

- **Residual Values Assumptions.** In ex-post evaluation we have calculated the expected residual value of the project at the end of the appraisal period by applying a linear depreciation over 30 to the capital expenditure incurred.
The ex-ante CBA also calculated the residual value of the project, but this was based on a series of calculations for each element of the project construction (bridges, tunnels, surfacing, message signing etc.)
7 M1 northern motorway in Ireland

7.1 Project characteristics

This project covers the construction of two sections of the M1 motorway in Ireland. The first section runs from Cloghran to Lissenhall and the second section joins this road with the Balbriggan Bypass further north. A separate application was submitted for each of the two sections (Cloghran to Lissenhall and Lissenhall to Balbriggan Bypass). The M1 Motorway is part of the TEN-T Priority Axis 13 (Ireland – United Kingdom – Benelux). The main objective of the investments in this corridor is the reduction in journey times between Ireland, the UK and mainland Europe.

The total aggregate cost for this project was €232m. The Cohesion Fund contributions (€152m) were used initially in the planning and pre-construction phases. This covered initial design, detailed design, site surveys and investigation, the Environmental Impact Assessment, a public consultation process and the preparation of contract documentation. For the next phase Cohesion Fund contributions were used for the construction of earthworks, the pavement, drainage, fencing and nine bridges. Interchanges, side roads and land acquisition were financed by the Irish Government. The eligible cost for co-financing was €173m.

The construction of the new sections of the M1 were required to upgrade the heavily congested existing N1 road and was seen by the Irish Government as being key to meeting European, national, regional and local objectives. The main objectives of the construction of this motorway was to improve transit times, safety levels and level of service and to provide essential infrastructure support for economic development (particularly industry and tourism) by improving access to Dublin’s port, airport and the main domestic markets.

The M1 Northern Motorway opened in June 2003.

7.2 Ex post CBA

7.2.1 Results of analysis

The following tables show the results of the ex post analysis. The analysis considers both a Low case and a High case, determined by the assumption about future economic growth and traffic levels. The evaluation assumed a project economic life of 30 years. The results indicate that the project offers very good value for money with a benefit cost ratio of just over 17 and an internal rate of return of 53%.
There is some uncertainty associated with this estimate, arising as a large proportion of the benefits have yet to be realised. These future benefits are intrinsically linked to the travel demands. To this end we have used the Ireland national road traffic growth estimates to give a high and low estimate of future traffic volumes and benefits. Broadly speaking there is about a 0.3% per annum difference in the respective traffic growth rates. This suggests a margin of error in the NPV of €100m. Whilst quite sizeable, given the very large NPV for this project this margin is only 2.6% of the NPV of the Low case.

As a consequence of the similarity in low and high growth rates we have undertaken an additional sensitivity test. This is a very conservative test. We have assumed that traffic volumes and benefits will not grow beyond 2009 (the last year for which we have ex post data). This test gives an NPV of €2.7 billion, a BCR of 12.65 and an IRR of 52%. Clearly the M1 is a very good project as, in this most unlikely of outcomes, the M1 shows a very good economic return.

Table 22. Five year ex post Appraisal: Total (€m, 2002 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low Case</th>
<th>High Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m)</td>
<td>3805</td>
<td>3905</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>53</td>
<td>53</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>17.2</td>
<td>17.6</td>
</tr>
</tbody>
</table>

Source: Own calculation
Notes: 5.5% discount rate, 30 year appraisal period

Table 23. Summary of ex post financial analysis (2002 prices)

<table>
<thead>
<tr>
<th></th>
<th>Low/High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value – Investment (€m)</td>
<td>-234.8</td>
</tr>
<tr>
<td>Financial IRR – Investment (%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Net Present Value – Capital (€m)</td>
<td>-81.4</td>
</tr>
<tr>
<td>Financial IRR – Capital (%)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: Own calculation
7.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** For the Low case scenario total benefits are €4 billion, of which 96% are estimated to arise from travel time savings. Environmental costs (e.g. carbon, noise and air pollution) have not been monetised and are not therefore included in these benefits.

- **Wider impacts** (addresses “Costs and benefits that cannot be expressed in monetary form”). It is difficult to establish a link between the project and wider socio-economic impacts as the project was implemented during a period of rapid growth in the Irish economy. It is however clear that the project has formed an important component of the general upgrade of the Ireland’s transport network. The construction of the project was a key factor in facilitating the construction of the second terminal at Dublin Airport. There is also evidence of substantial growth in the towns adjacent to the project – where the congestion levels have dropped as a result of the M1 Northern Motorway.

- **Meeting environmental requirements.** An extensive Environmental Impact Assessment was carried out for this project in March 1998. This detailed the required mitigation measures that were to be put in place. These included an archaeological survey, some replacement of flora lost during construction, culverts for small animals and noise barriers. The crossing of the river estuary also required a bridge that was sensitive to the environment. It is estimated that environmental mitigation measures added €8.8m to the construction costs (2002 prices).

- **Utilisation.** This section of the M1 was built as a 2 lane dual carriageway at motorway standard. It was designed to allow it to be converted into a 3 lane motorway at some point in the future. We have estimated that the the Annual Average Daily Traffic (AADT) flow at which the carriageway is likely to be ‘congested’ in the peak periods on an average day is 65,000 vehicles. If the road were to be widened in the future this would increase to an estimate of 97,000 vehicles. Traffic flows on the southern section of the route are approaching 80,000 vehs (AADT) and on the northern section are just over 50,000 vehicles. The road in its existing standard is therefore approaching capacity, even though it is only 7 years into its lifetime. Traffic growth, particularly on the southern section of the route, has been much higher than was originally anticipated.

- **Unit costs.** Unit cost data for the M1 Northern Motorway was only available at the coarsest level of disaggregation - Level 1. The unit cost data is reported in the case study annex.
- **Main project risks and consequences.** The main risks to the ex post CBA is that associated with lower than expected economic and population growth. A slower economy and less people would mean that the M1 Northern Motorway will deliver less benefits than have been anticipated. To quantify this risk we have estimated a conservative scenario in which traffic levels do not increase above 2009 levels for the remainder of the 30 year asset life. In this most conservative of scenarios the project still represents good value for money with an NPV of €2.7 billion, a BCR of 12.65 and an IRR of 52%.

- **Accompanying actions (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”).** Since the opening of the M1 Northern Motorway between Cloghran and Balbriggan Bypass a number of additional sections have been opened along the route. The M1 now provides a complete motorway standard link from Dublin to Northern Ireland.

- **Unintended effects.** We did not identify any unintended effects.

### 7.3 Ex ante CBA

#### 7.3.1 Results of analysis

The table below provides a summary of the ex ante results. The analysis shows that the project was expected to achieve a high value for money, but not as high as the ex post analysis has indicated it does.

<table>
<thead>
<tr>
<th>Net Present Value</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>303</td>
<td>16.08%</td>
</tr>
</tbody>
</table>

Source: Fingal County Council – An application of economic appraisal methods to the northern motorway project

#### 7.3.2 Key aspects of the ex ante CBA

- **Quality of analysis (addresses “Validity of assumptions made during the ex ante analysis”).** Our review of the ex ante CBA that was undertaken in 1995 (four years prior to application to the Cohesion Fund) is that the analysis meets best practice in appraisal for that time (1995). Against current standards however the CBA itself would be viewed as acceptable but the traffic

M1 northern motorway in Ireland
modelling input to it would be regarded as inadequate. By today’s standards, in our view, if this project were to be repeated it would be necessary to enhance the traffic modelling to:

- model junction delays;
- model re-assignment of traffic between the N1 and the M1 (instead of using a fixed diversion approach as was used in the ex ante analysis); and
- undertake an assessment of induced traffic, even if that assessment determined that induced traffic was unlikely to be an issue.

**Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). The 1995 ex ante CBA undertook 9 sensitivity tests each with 3 different discount rates (i.e. 27 scenarios in total). Of these 27 tests, only two (zero economic and traffic growth with a 10% and 8% discount rate) didn’t give a positive NPV. The sensitivity tests focussed on different traffic growth scenarios and different marginal values of time and accidents. Given the actual outcomes of the project the actual risk bearers were the investment costs (which were 58% higher than was assumed in the ex ante), travel demand (which is about 70% higher today than was expected for 2020), the number of accidents saved which is much lower than was assumed in the ex ante, and the opening year of the project (June 2003) which was 3 years later than was anticipated in 1995. As can be seen the ex ante risk analysis did not pick up the actual risk bearers particularly well.

### 7.3.3 Role of ex ante CBA

In short the role that ex ante CBA plays in decision-making has altered since 1995. In 1995, at the time of the application, it is apparent that CBA played no role in the decision making process for the M1 Northern Motorway, but today ex ante CBA forms an integral part of current transport appraisal methods used in Ireland (and therefore the decision-making). There is still scope for improvement today, as not every decision made by government and its institutions is based on CBA but the situation is very different from 1995.

In 1995 when the ex ante CBA was undertaken the preferred route, alignment and design standard and already been selected. This selection was based on a series of engineering studies. The CBA therefore played no role in the definition of the project. What the CBA did do was confirm the view held by decision-makers that the project was good value for money.
7.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

- **Discount rates.** The discount rate used in the ex post (5.5%) is higher than that used in the ex ante analysis (5%). Both are however of the same order of magnitude and would be regarded as risk free discount rates based on social time preferences. They are both therefore consistent with current CBA methods.

- **Differences between economic and financial NPV.** There are three main reasons for the difference between the ex ante and the ex post results. These are differences in capital costs, travel demands and travel delays. The latter two reasons are the primary reasons for the large difference in benefits between the ex ante and the ex post. The traffic input to the ex ante CBA did not include junction delays – which are substantial. This combined with the fact that the motorway carried 70% more traffic in 2009 than was expected in 2020 means benefits in the ex ante were severely underestimated. This increase in benefits is so large that it swamps the substantial 58% increase in capital costs.

- **Time and cost overruns.** As discussed above outturn investment costs were 58% higher and the project opened 3 years later than was originally anticipated in 1995. There are a number of reasons why there was an overspend compared to both the original ex ante estimate and the original costs submitted to the EC. These include:
  - The discovery of a number of archaeological sites leading to the contractors’ contract being extended.
  - Delay and disruption. A long list of reasons for delays and disruption were submitted. These include lack of possession of parts of the site outside and within the motorway reservation, flooding caused by blockages upstream and off site.
  - The redesign of culverts (designed to protect the badgers)
  - Re-measurement Clause – The Irish Government has a clause by which the costs can be re-measured once the contract has been awarded to pick up any changes to the contract. This meant that the costs that were submitted to the EC were not the final costs (as was expected by the EC), but had the ability to be updated. This lead to a dispute between the EU and Ireland, which was only resolved in June 2010 in Ireland’s favour. It is not common practice across the EC to re-measure costs after they have been approved.
Changes due to the price variation clause.
8 Railway Thriassio-Pedio-Eleusina-Korinthos in Greece

8.1 Project characteristics

The project covers a rail upgrade between Thriasio (north west of Athens) and Kiato in Greece. A new standard gauge double track line has been built to replace a former single track metric line. The 112km section runs parallel to the European TEN-T network Motorway Priority Axis 7 (Igoumenista-Patras-Athens-Sofia-Budapest) and forms part of longer term proposals to upgrade the Piraeus-Athens-Patra line.

The line included four funding applications for cohesion funding. Three of the sub-projects related to the section of track running from Thriasio to Korinthos. An additional funding application was made for the section of track between Korinthos and Kiato. The total cost of the project was €508.0m. Of this, the total amount eligible for EC funding was €238.4m, 47% of the total spend.

The old line had poor geometric features, dated infrastructure and low track speeds. The line, along with the wider Peloponnesian network, was in an unfavourable situation in terms of demand and financial results. This section of the network was stated as comprising 34% of all OSEs operating costs but only 6% of total revenue. It was considered that the scheme was a vital intervention to prevent the decline of the railway, and to allow the line to be compatible with the remainder of the standard gauge rail network in central and northern Greece. The main objectives of the scheme were to reduce travel times on the line and to increase rail revenues whilst decreasing rail operating costs.

8.2 Ex post CBA

The extent of primary data provided for the ex-post evaluation by the national rail operator (TRAINOSE) has been limited. TRAINOSE is currently undergoing organisational restructuring and have had difficulties supplying and extracting data. As a result this evaluation has relied to an extent on published secondary sources to analyse operating costs, and to approximate passenger km travelled on the line.

8.2.1 Results of analysis

The initial appraisal considered the final desired extent of the scheme to Patra, which would provide a rail link from Greece to Western Europe via the port of Patra. This final section of the line is not yet completed; the original appraisal assumed the extension to Patra would be opened by 2011 although this is now thought to be delayed with completion not expected until between 2015 and 2020.
Consequently the evaluation only considers the current extent of the scheme to Kiatο.

The tables below show the results of the ex-post analysis for the new line. To capture the uncertainty depending on future traffic levels, and the associated margin of error of the ex post analysis, we have defined two scenarios (Low case and High case). As part of future works the old line beyond Kiatο has been closed. The low and high growth scenarios consider the levels of demand which could be expected on the line originating from beyond Kiatο if the remaining network had remained open. The low growth scenario assumes that demand on the line beyond Kiatο would remain at observed pre-scheme levels, whilst the high growth scenario assumed that rail growth from beyond Kiatο would have increased as forecast in the ex-ante appraisal.

The economic analysis shows that, for both cases, the project has delivered a positive benefit-cost ratio. The financial analysis shows a negative NPV with relation to the total investment, although the scheme has produced positive financial results with relation to national capital.

### Table 25. Summary of ex-post economic analysis (2000 Prices discounted to 2000, Discount Rate 5.5%, 2000-2035)

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m @ 5.5%)</td>
<td>31.90</td>
<td>257.83</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>6.05%</td>
<td>9.30%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>1.10</td>
<td>1.79</td>
</tr>
</tbody>
</table>

Source: Own calculation

### Table 26. Summary of ex post financial analysis (2000 Prices discounted to 2000, Discount Rate 5.0%, 2000-2035)

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value – Investment (€m @ 5%)</td>
<td>-184.1</td>
<td>-100.9</td>
</tr>
<tr>
<td>Financial IRR – Investment (%)</td>
<td>1.84%</td>
<td>3.40%</td>
</tr>
<tr>
<td>Net Present Value – Capital (€m)</td>
<td>10.2</td>
<td>93.5</td>
</tr>
<tr>
<td>Financial IRR – Capital (%)</td>
<td>5.27%</td>
<td>7.30%</td>
</tr>
</tbody>
</table>

Source: Own calculation
8.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** Proportionately, a majority of the scheme benefits have come from producer surplus components including revenue from passengers and maintenance and operating cost savings for both rail and road. The scheme also produced significant consumer surplus as a result of journey time savings. These key sources of scheme benefits are as identified in the ex-ante analysis.

- **Wider impacts.** The new line is approximately 3 years into its expected economic life, whilst economic and social impacts often take many years to materialise. In addition in the years since scheme opening the economic downturn is likely to have offset some of the potential of the scheme. Consequently the wider impacts of the scheme are hard to isolate although the following headline messages were drawn from the ex-post analysis:
  - A number of stations on the new line are in peripheral locations relative to their previous town centre positions, as a result they are less accessible compared to the stations located on the old routes;
  - The out of town stations do offer a focal point for development and have been integrated into local town master planning exercises;
  - The removal of trains from the built up areas, and associated level crossings, has offered local congestion benefits and benefits in terms of noise, poor air quality and congestion caused by traffic disruption at level crossings;
  - The true wider economic benefits of the scheme are unlikely to materialise until the line completes the rail link between Patra port and Athens.

- **Meeting environmental requirements.** As a separate process to the CBA full environmental approvals were granted for the study.

- **Utilisation.** Current demand estimates would give an average train loading of 23% (assuming 500 seats per train). As part of future works the old line beyond Kiato has been closed. Given low and high-growth scenarios in the event of this line having remained opened, the average train loading would have rise to between 33% and 58% (assuming the same service frequency).

- **Unit costs.** Level 2 forecast and outturn unit costs were received for the section of the scheme between Thriasio and Korinthos. Outturn costs were provided in the year of spend whilst forecasts were in 2000 prices; as a result the two were not directly comparable. Generally the largest overspend in
terms of unit cost appears to be on land, although this was a small proportion of the total spend.

- **Main project risks and consequences.** The key risks for the project, identified at the time of the ex ante analysis, were lower than forecast traffic volumes and increased construction costs, and these were subject to sensitivity tests. No other other sensitivity tests were reported. The potential impact of these risk factors was assessed in the ex ante analysis. In all cases, the project was found to be NPV-positive. Therefore, no particular risk mitigation action was implemented.

- **Accompanying actions.** The completed line to Kiato forms part of longer term proposal to upgrade the entire Piraeus-Athens-Patra line. The extension to Patra was considered in the ex-ante appraisal, and would be necessary to release benefits associated with providing a rail link to Western Europe via the port of Patra. Also, once completed, there are plans for an inter-modal facility at Thriassio, such that freight from Patra would travel by rail to Thriassio, and then onwards by road or rail to other parts of Greece.

- **Unintended effects.** No unintended effects were identified as a result of the scheme, however it was commented that there is potential for land use development around the out-of-town stations along the route, although these have not come to fruition yet.

### 8.3 Ex ante CBA

#### 8.3.1 Results of analysis

The following tables present the economic and financial results from the ex-ante analysis. The tables show that the scheme was forecast to produce a positive economic return although was not forecast to produce a net financial benefit.
Table 27. Results of ex ante cost benefit analysis (2000 Prices discounted to 2000, Discount Rate 5.0%, 2000-2035)

<table>
<thead>
<tr>
<th>Net Present Value (€ million, 2000 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>396</td>
<td>7.3%</td>
</tr>
</tbody>
</table>

Source: ex-ante CBA (November 2000)

Table 28. Comparison of ex ante financial analysis (2000 prices)

<table>
<thead>
<tr>
<th>Investment Costs (€ million, 2000 prices)</th>
<th>Net Present Value (€ million, 2000 prices)</th>
<th>Financial IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>1045</td>
<td>-469</td>
</tr>
</tbody>
</table>

Source: ex-ante CBA (November 2000)

8.3.2 Key aspects of the ex ante CBA

- **Quality of analysis.** The overall quality of the ex ante analysis was good. The analysis was carried out by TRADEMCO on behalf of ERGOSE. The methodology used to estimate benefits was robust and used parameters in line with guidance of the time. Although using a relatively basic methodology the appraisal has included a modelled estimate of mode shift as a result of the scheme. The ex ante appraisal considered future operating costs on the basis of a ‘per passenger km’ rate taken from existing modern railway lines in Greece. It is considered that a ‘per train km’ basis would have been more suitable, being less reliant on a comparable passenger demand to that on existing lines.

- **Ex ante risk analysis.** In order to test the robustness of the economic appraisal, the CBA examined a number of sensitivity tests around the central case. Sensitivity tests included:
  - Income from the operation of a scenario will be 10% lower or higher.
  - The cost of the new line would be 10% higher or lower.
  - The cost of the work remaining to be executed will be 10% or 20% higher or lower than anticipated.

The lowest IRR as a result of sensitivity testing was 6.3% (compared to and using a discounting rate of 5.0%) demonstrating a robustness of economic benefits for the scheme.
The ex-ante analysis did not consider the risk of delays to the additional section of the line beyond Kiato to Patra. The costs and benefits of the additional section were considered in the CBA but had not received funding at the time of the application.

8.3.3 Role of ex ante CBA

The CBA was recognised as being both a necessary procedure to complete the funding application and a useful tool for prioritising options within schemes where alternative options could be tested. However in this case the ex-ante CBA was not used as a tool to compare alternative options for route alignment as it was considered by the member state that alternative alignments were not a realistic option due to the topography of the area.

Similarly the CBA was not used to prioritise between different schemes within Greece. Decisions at the national level were based on the requirements for improving the priority axes and the total funding allocated to Greece.

8.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA. The ex ante cost benefit analysis considered the costs and benefits for the implementation of all improvements from Thriasio – Patra. Currently the line has only been completed to Kiato. Consequently a direct comparison of the ex ante and ex post evaluations is not appropriate for providing an indication of the accuracy of ex ante evaluation methods, however headline differences are drawn out below.

- Issues with the ex-ante analysis. With regards to consumer benefits the ex-ante analysis only considered the beneficial impact of reduced journey times and not the negative impact of increased fares. The ex ante analysis assumed a lower background growth in the Do-Minimum scenario, assuming that the old rail network could not cater for the background demand in growth. The ex ante appraisal did not calculate any consumer benefits for the passengers who were classified as ‘existing’ in the Do-Something scenario but not in the Do-Minimum. Scenario.

- Omissions in the ex-ante analysis. The ex-ante analysis had not considered the impact of different station locations on the new line. A number of stations are in out of town locations and could be a factor in outturn passenger demand appearing to be marginally lower than forecast. In addition the ex-ante appraisal had not considered the safety benefits of removing the level crossings from the route.
Different assumptions between the ex-ante and ex-post analysis. With regards to the benefits a number of valuations and assumptions were updated from the ex ante analysis. These changes included:

- **Journey time savings** – Outturn journey time savings between Athens and Korinthos were 30 minutes compared to a forecast of 40 minutes.

- **Value of Time** – The VOT of rail passengers in the ex-ante appraisal was €3.24 per hour, an updated value of €6.21 per hour was calculated from HEATCO valuations of time assuming the same split in journey purpose.

- **Fares** – A fare premium was assumed in the ex-ante assessment increasing fares from €0.0396 to €0.0763 per passenger km by 2011. Outturn analysis suggests that a fare premium of this magnitude has not been implemented with average fares being equivalent to €0.0409 per passenger km.

- **Operating Costs** – The Do-Minimum scenario calculated operating costs on a ‘per passenger km’ basis. This assigned operating costs of €0.0998 per passenger km in the Do-Minimum scenario and €0.0452 per passenger km in the Do-Something scenario. The ex-post evaluation has calculated operating costs using a derived operating rate per train km and passenger timetables.

- **GDP** – Background rail growth is linked to GDP. GDP growth of 3.5% was forecast between 2006 and 2010. Outturn analysis shows that due the recession real GDP per capita in Greece was approximately the same in 2010 as it was in 2006.
9 IX B corridor in Lithuania

9.1 Project characteristics

This project covers the modernisation of one of the two main motorway routes in Lithuania. This is part of the IX B transport corridor, 315km of motorway linking the port city of Klaipeda with the capital city of Vilnius, via Kaunas. The route then links Lithuania with other destinations in Eastern Europe. The project also involved the construction of the Vilnius Southern bypass.

The total aggregate cost for this project was €154m, while the total amount eligible for funding was €148m, or about 96 per cent of the total. The total ISPA/Cohesion Fund contribution was €121m, equal to about 82% of the eligible project costs.

The modernisation of the IX B Corridor was required to prepare this motorway, a key element of the Lithuanian transport network, for higher and heavier volumes of commercial traffic expected in the coming years. The main objective for the construction of the Vilnius Southern bypass was to reduce chronic delays caused by transit and local traffic being forced through the historic district of the city.

9.2 Ex post CBA

9.2.1 Results of analysis

Due to their different characteristics, we consider the Upgrading of the IX B Corridor and the Construction of the Vilnius Southern Bypass separately.

The tables below show the results of the ex post analysis for the Upgrading of the IX B Corridor. To capture the uncertainty depending on future traffic levels, and the associated margin of error of the ex post analysis, we have defined two scenarios (Low case and High case). To define the High Case, we applied the growth rates that the Lithuanian Road Authority (LRA) assumed for the ex ante analysis. For the Low Case, we assumed traffic not to grow further above 2009 levels.

The economic analysis shows that, for both cases, the project has delivered a very satisfactory IRR and BCR. The financial analysis shows a negative NPV. This is to be expected as this is not a revenue-generating project.
Table 29. Summary of ex post economic analysis (2009 prices) - IX B Upgrading

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m @ 5.5%)</td>
<td>200.3</td>
<td>212.2</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>55%</td>
<td>56%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>3.3</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Source: Own calculation

Table 30. Summary of ex post financial analysis (2009 prices) - IX B Upgrading

<table>
<thead>
<tr>
<th></th>
<th>Low case</th>
<th>High case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value – Investment (€m @ 5%)</td>
<td>-95.0</td>
<td>-95.0</td>
</tr>
<tr>
<td>Financial IRR – Investment (%)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Net Present Value – Capital (€m)</td>
<td>-28.0</td>
<td>-28.0</td>
</tr>
<tr>
<td>Financial IRR – Capital (%)</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: Own calculation

The Vilnius Southern Bypass was declared completed in 2009. In the same year, the Vilnius Municipality prepared a Final Report to monitor the performance of the project after opening. The following table summarises the results of this analysis, which we have reviewed. The results show that the project has so far delivered a very satisfactory IRR. No financial analysis was carried out as this is a non-revenue generating project.
Table 31. Summary of ex post economic analysis (2009 prices) – Vilnius Bypass

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m @ 5%)</td>
<td>142.1</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>29.1%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Source: Vilnius Municipality Final Report for the Southern Bypass

9.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** Given the differences between the two projects, we have carried out the ex post CBA analysis separately for each project. The main benefits from the upgrading of the motorway are originated by savings in vehicle operating costs. The Vilnius Southern Bypass, on the other hand, generates most of its benefits as time savings. These results are in line with the findings of the original ex ante analysis.

- **Wider impacts** (addresses “Costs and benefits that cannot be expressed in monetary form”). The project was implemented against a backdrop of rapid economic growth. Therefore, it is difficult to establish a causal link between it and specific impacts. Nonetheless, it is clear that the project contributed significantly to the upgrading of the Lithuanian transport network. Together with other projects, it helped set up Free Economic Zones and open new logistic centres. It also contributed to the regeneration of brownfields along the motorway (for example with the set up of new shopping and residential centres).

- **Meeting environmental requirements.** The environmental impacts of the project have been comprehensively assessed in the project final report. This study found that, based on the results of water pollution, the impact of the road upgrading works as well as of that of the operating road on the quality of surface water bodies has not been significant. With regards to soil pollution, the study found that the levels recorded were within the allowed limits. Therefore, it concluded that the impact of the project on soil pollution, both during construction and operation, has not been significant.

- **Utilisation.** With regards to the utilisation of the current infrastructures, we were informed that, at the stage of the ex ante analysis, demand modelling was carried out to identify the level of capacity needed to accommodate the expected levels of traffic for several years. All projects were sized accordingly
to these results. In fact, traffic has grown faster than expected, getting closer to the maximum capacity of the motorway. However, the recent economic crisis has reduced traffic volumes significantly, thus postponing any issues of congestion. With regards to the Vilnius bypass, the Municipality of Vilnius reported that the link is operating well below its maximum capacity. Currently, at peak times there are 44,000 vehicles per day, while full capacity would be between 60,000 and 70,000 vehicles per day.

- **Unit costs.** We did ask for the information necessary to calculate unit costs according to the methodology defined in WP10. However, we were informed that data had been recorded according to different criteria. This implied that it would not have been possible to re-construct unit cost indicators according to the WP10 methodology, other than a Level 1 unit cost.

- **Main project risks and consequences.** The key risks for these projects, already identified at the time of the ex ante analysis, were an unexpected reduction in traffic volumes and an increase in construction costs. The potential impact of these risk factors was assessed in the ex ante analysis. In all cases, the project was found to be NPV-positive. Therefore, no particular risk mitigation action was implemented.

- **Accompanying actions** (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). With the exception of information campaigns (on national newspapers, radio, television and websites) no other action to enhance the project success was undertaken.

- **Unintended effects.** Both projects do not appear to have had any unintended effects. They both addressed real needs, as shown by the results of the ex post evaluation. They directly contributed to the development of the Lithuanian road network and, indirectly, to Lithuania’s economic growth over the last ten years.

### 9.3 Ex ante CBA

#### 9.3.1 Results of analysis

Also in this case, due to their different characteristics, the two projects have been considered separately. The following tables show the results of ex ante analysis, for the upgrading of the IX B Corridor and the Vilnius Bypass respectively. The analysis showed that both project were expected to deliver a very satisfactory IRR and BCR.
Table 32. Results of ex ante cost benefit analysis – IX B Upgrading

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 1999 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>60.9</td>
<td>21.8%</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Source: Transport and Road Research Institute (1999), Upgrading of IX B Transport Corridor. Economic evaluation

Table 33. Results of ex ante cost benefit analysis – Vilnius Southern Bypass

<table>
<thead>
<tr>
<th></th>
<th>Net Present Value (€ million, 2009 prices)</th>
<th>Economic IRR (%)</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do-something</td>
<td>111.9</td>
<td>22.8%</td>
<td>4.5</td>
</tr>
</tbody>
</table>

Source: Funding application for project 2004/LT/16/CPT/008

9.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** (addresses “Validity of assumptions made during the ex ante analysis”). The overall quality of the ex ante analysis was good. For both project, the analysis was carried out by the Lithuanian Transport and Road research institute, which applied the latest relevant guidance. In particular, the methodology used to estimate the benefits from vehicle operating costs savings appears to be rigorous and comprehensive. Following the initial 1999 report, the analysis was further updated at the time of the subsequent funding applications. These updates extended the scope the analysis to include the assessment of other impacts such as safety benefits and time savings.

- **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). After presenting the results of the ex ante analysis for the upgrading of the IX B Corridor, the 1999 Report provides the result of the sensitivity analysis that was carried out to assess the impact of uncertainty on the CBA results. The results of the sensitivity analysis show that, in all cases, the IRR and benefit-cost ratio of the project remain satisfactory. Even under the most unfavourable scenario (low traffic growth and high construction costs) the project’s NPV is largely positive.
9.3.3 Role of ex ante CBA

In Lithuania, the ex ante CBA is not used to choose between alternative projects competing for limited funding. In fact, most projects involve the improvement and upgrading of existing infrastructures. These projects have already been identified in the National Transport Development Plan as investments that need to be undertaken. In most cases, there are no alternative options for implementation and it would be unnecessarily costly to identify unfeasible alternatives just for the purposes of the analysis. For example, in the case of the upgrading of an existing road, the link route is already defined (and often already in use). Instead, the Lithuania Road Administration uses ex ante CBA as a way to identify the project specifications (such as the design of a junction) and technologies (such as the asphalt type) that would yield the best value for money. The LRA carry out the analysis for each specific part of the project independently, without recalculating the entire NPV and BCR for the whole project. Therefore, the analysis that the LRA carries out is not a full CBA as such. Nonetheless, the LRA sees ex ante appraisal as a useful tool to avoid the “gold plating” of projects and to make specific implementation decisions.

9.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

- **Discount rates.** In the ex ante analysis both the economic and financial NPVs were calculated using a 5% discount rate. This was the value recommended at the time. Since then, the economic discount rate has been increased to 5.5%. We have used this value in the ex post analysis.

- **Differences between economic and financial NPV.** The ex post NPV is more than double the ex ante NPV. The IRR and benefit-cost ratio are also significantly higher in the ex post evaluation compared with the ex ante. This large increase in the NPV is driven by the higher-than-forecast vehicle operating costs savings. In turn, VOC savings are driven by traffic volumes. While total traffic has grown generally in line with the forecast during the early years of the project, it has exceeded the forecast in the latter year. Moreover, heavy traffic has grown more than expected, yielding larger unit vehicle operating cost savings on a per-vehicle-kilometre basis.

- **Time and cost overruns.** With regards to the Upgrading of the IX B Corridor, the final costs were similar to those originally considered in the ex ante. The overall project took longer to complete, although no specific reason for this delay was provided. As long sections of the road remained operational during construction, we expect this delay to have had only a
limited impact on the total project cost. With regards to the Vilnius Southern Bypass, the Final Report shows that the ex post construction costs were higher than originally estimated. The original contribution from the Cohesion Fund was subsequently increased to meet the additional costs. Unfortunately, the report does not provide a justification for the increase in costs.
Bratislava Rača – Trnava Railway Upgrade in Slovakia

10.1 Project characteristics

This project covers the modernisation of the railway link between Bratislava (Rača) to Trnava – approximately 40km of track in a north-easterly direction out of Bratislava. The rail link forms part of the Trans-European Network (TEN-T) and is situated on Corridor Va which links Bratislava to Košice across Slovakia.

The overall project is made up of two phases and was declared completed in 2009:

- Phase One – Bratislava Rača and Šenkvice line upgrades;
- Phase Two - Šenkvice and Cífer line upgrades and improvements to rail stations Bratislava Rača, Svaty Jur, Pezinok, Šenkvice, Bahon, Cífer and Trnava.

The total aggregate cost for the two phases of the project was €213m with the total amount eligible for funding being €163m, or about 76 per cent of the total. The total ISPA/Cohesion Fund contribution was €89m, equal to about 55% of the eligible project costs.

The main objective of the project was modernising the electrified line and to support speeds of up to 160 km/h. The two schemes were also introduced to increase safety on the line and to comply with EU interoperability requirements. The project included two schemes involving line and track works, as well as upgrades to a number of stations along the alignment. The works will assist in improving transport connections across Slovakia, and encourage movements between the two business metropoles of Bratislava and Košice as well as better connections to the TEN-T network.

10.2 Ex post CBA

10.2.1 Results of analysis

The analysis of the two schemes (line upgrades and station improvements) have been combined for the purpose of the ex ante review and ex post assessment.

The tables below show the results of the ex post analysis for the upgrading of the Bratislava Rača to Trnava rail line. The tables summarise the ex post results from the economic analysis for a range of scenarios including two central case scenarios based on a 20 year and 30 year assessment period and demand increases aligning with projected GDP growth and a demand elasticity value of 1. To capture the uncertainty depending on GDP levels, we have included a low
and high case scenario. The low growth assumes a 20% decrease in GDP forecast, with a passenger demand elasticity of 0.8. The high growth assumes a 20% increase in GDP, with a passenger demand elasticity of 1.2.

The economic analysis shows that, for both cases, the project has delivered a very satisfactory IRR and BCR. The financial analysis also shows a positive NPV showing that the project has been exceptionally good value for money.

Table 34. Summary of ex post economic analysis (2008 prices) – Bratislava Rača–Trnava Rail Upgrading

<table>
<thead>
<tr>
<th></th>
<th>20 years</th>
<th>30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Central</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>39.6</td>
<td>63.8</td>
</tr>
<tr>
<td>(€m @ 5.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>7.81%</td>
<td>8.97%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>1.41</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Source: Own calculation

Table 35. Summary of ex post financial analysis (2008 prices) – Bratislava Rača–Trnava Rail Upgrading

<table>
<thead>
<tr>
<th></th>
<th>20 years</th>
<th>30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Central</td>
</tr>
<tr>
<td>Net Present Value</td>
<td>-27.7</td>
<td>-20.7</td>
</tr>
<tr>
<td>Investment (€m @ 5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial IRR</td>
<td>3.34%</td>
<td>3.80%</td>
</tr>
<tr>
<td>Investment (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Present Value</td>
<td>64.8</td>
<td>68.9</td>
</tr>
<tr>
<td>Capital (€m)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial IRR</td>
<td>13.56%</td>
<td>13.56%</td>
</tr>
<tr>
<td>Capital (%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own calculation
10.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** The main sources of benefits identified in the ex-post evaluation come from journey time savings and also the saved emergency repair works which would have otherwise been required. Journey time savings of approximately 10 minutes were achieved for the section between Bratislava Rača and Trnava. However, there has been a significant increase in economic growth in Slovakia and with this increasing car ownership - and thus passenger demand on the line has declined. This is also affected by further rail works upstream of the project which cause delays on this section of line. It is likely therefore that demand levels have not yet reached their optimum levels.

- **Wider impacts** (*addresses “Costs and benefits that cannot be expressed in monetary form”*). The project was implemented against a backdrop of rapid economic growth in Slovakia, therefore it is difficult to establish a causal link between the project and specific regional economic impacts. Nonetheless, it is clear from our consultation with stakeholders that the project (and ongoing and future proposals to upgrade the full rail line between Bratislava and Kosice) is regarded as a key enabler of economic growth across Slovakia. The main benefits of the scheme identified by stakeholders include: faster and more reliable connectivity between the key business metropoles of Bratislava and Kosice, and also for linking Slovakia and its neighbouring countries. Furthermore, this rail upgrade offers better accessibility to manufacturing jobs in Trnava, and to areas of tourism including the Carpathian Mountains.

- **Meeting environmental requirements.** The project has had limited impact on the environment – particularly as it was an upgrade of an existing electrified rail link. Due to this, an Environmental Impact Assessment was not undertaken. Whilst there was some environmental impact during construction, this has been mitigated through the planting of numerous species including “*potentilla fruticosa*” and “*spiraea bumalda*”.

- **Utilisation.** The utilisation of the project since opening has been calculated by considering the ratio between annual seat capacity and annual passenger demand. Due to the decline in demand, calculations show that utilisation rates on the line section have dropped from 35% to 29% between 2001 and 2009. It should be noted that the further improvements upstream are causing delays on this section and it is likely that utilisation will not increase until these works are completed;

- **Unit costs.** The outturn costs obtained for this project have been disaggregated by the categories of works, which does not meet the requirements defined in WP10. However, these categories do provide a
strong indication of the key expenditure categories for the two phases of the project, with new railway bridges making up almost 25% of the costs of phase one, and signalling and cabling making up approximately 20% of the costs of phase two.

- **Main project risks and consequences.** Project risks were identified at the time of the ex-ante analysis and sensitivity tests were largely focussed on assessing economic impacts based on cost uncertainties, and using various discount rates. Demand levels were not including in the ex-ante sensitivity testing, and with the decline in passenger demand since the opening of the scheme, it is clear that this would have been appropriate at the ex-ante stage.

- **Accompanying actions** *(addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”).* With the exception of information campaigns (on national newspapers, radio, television and websites) no other action to enhance the project success was undertaken.

- **Unintended effects.** At this stage it is clear that the decline in passenger demand on the line has not impacted negatively on the project. However, it appears that the increased car ownership levels and the upstream works causing impact to this section of the line had not been accounted for in the ex ante stages of the assessment. The latter of course should improve when the full section of line (north of this project considered) is completed in full.

### 10.3 Ex ante CBA

#### 10.3.1 Results of analysis

The tables below show the results of ex ante economic analysis and the financial analysis. There is a discrepancy of €1m in the investment costs between the financial and economic cases which affects the net present value of each case. The ex-ante cases used a high discount rate of 10% in the economic case which has been amended to 5.5% in the ex post case. The high discount rate used significantly reduces the weighting of the benefits in the future years compared to the initial capital expenditure. The scheme still however generates a positive benefit to cost ratio of 0.99 in the ex ante case.

The results of the financial case mirror those in the economic case (except the €1m discrepancy in investment costs). This is due to the ex ante assessment not including revenue gains as part of the project.
### Table 36. Results of the ex ante economic analysis

<table>
<thead>
<tr>
<th></th>
<th>Investment Costs (€m, 2001 prices)</th>
<th>Net Present Value (€m, 2001 prices)</th>
<th>Economic IRR (%) - discounted at 10%</th>
<th>BCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bratislava Rača-Šenkvice 2000/SK/16/P/PT/001</td>
<td>55.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Šenkvice-Cifer and stations Rača-Trnava 2001/SK/16/P/PT/003</td>
<td>117.72</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total of two subprojects</strong></td>
<td>173.09</td>
<td>-0.77</td>
<td>9.93%</td>
<td>0.99</td>
</tr>
</tbody>
</table>

Source: Application for Funding: Project 2001/SK/16/P/PT/003

### Table 37. Results of ex ante financial analysis

<table>
<thead>
<tr>
<th></th>
<th>Investment Costs (€m, 2001 prices)</th>
<th>Net Present Value (€m, 2001 prices) discounted at 10%</th>
<th>Financial IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total of two subprojects</strong></td>
<td>172.09</td>
<td>0.78</td>
<td>10.08%</td>
</tr>
</tbody>
</table>

Source: Application for Funding: Project 2001/SK/16/P/PT/003

#### 10.3.2 Key aspects of the ex ante CBA

- **Quality of analysis** *(addresses “Validity of assumptions made during the ex ante analysis”)*. The CBA presented at the time of the ex-ante appraisal was complete and broadly consistent with CBA guidance expectations at the time of preparation, and was particularly strong as the main assumptions were attached as appendices to the submission. However we identified a number of issues for further consideration:
  - Assumptions regarding demand for the scheme align with GDP forecasts, and no demand growth has been assumed in the base case (i.e. natural growth);
  - The ex ante assessment assumes that all users of the scheme will transfer from the highway and therefore does not account for induced users; and
• No assessment of the monetary impacts of externalities such as noise, CO2 and air quality was included in the CBA.

• **Ex ante risk analysis** (addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”). Due to the decline in passenger demand on this section of line following implementation of the scheme, it is clear that more rigorous sensitivity testing on demand forecasts for the scheme are necessary. Whilst the demand has presumably been affected by the upstream works, this could have been factored in during the ex ante assessment stage. In the sensitivity tests which were carried out using higher construction costs and reduced operational costs savings, the project NPV clearly becomes more negative.

### 10.3.3 Role of ex ante CBA

The stakeholders had no negative comments about the CBA process, rather they were supportive of the thorough assessments and procedures in place to get assistance and receive funding for their transport infrastructure projects. ŽSR advocated that projects could not be funded through government money and therefore the only option was to apply for funding for projects via the EU. Due to this the Slovak authorities take the ex ante appraisal process very seriously, something which is demonstrated by the level of detail included in both the ex ante appraisal forms, technical appendices and also the ex post Final Report.

It was however clear in the case of Slovakia, that the overall aspirations to upgrade the rail Corridor V dictate the schemes which are seeking funding, rather than the CBA process helping to decide which schemes will offer the greatest value for money.

### 10.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

• **Discount rates.** In the ex ante analysis both the economic and financial NPVs were calculated using a 10% discount rate. In the ex post analysis, the discount rate has been reduced to 5.5% to match the requirements of the EC Guide on Investment Appraisal.

• **Capital Costs.** The ex-post evaluation shows that investment costs were higher than expected; these can largely be attributed to procurement delays; and variations to works.

• **Appraisal Period.** The ex ante assessment is based on a 20 year assessment period. This has been replicated in the ex post assessment, but a 30 year
assessment has been undertaken in line with the recommended appraisal period for rail projects from current guidance.

- **Values of Time.** The majority of the project benefits come from reduced journey times. There is a significant difference in the value of passenger time, applied which has increased from €2.7/hour in the ex ante analysis to €6.96/hour in the ex post. Additionally, in the ex post assessment, the value of passenger time increases into the future with GDP growth and an elasticity of 0.7 but the values were fixed across the full appraisal period in the ex ante case.

- **Rail Journey Length.** The ex ante CBA assumed the average rail journey would be the length of the upgraded line (39km). The ex post assessment assumes that people may travel beyond the length of the improved line and has applied the length of the average rail journey, as taken from the ZSSK 2009 Annual Report – this is 49.77km. This has an impact on the external benefits, which are calculated as the road kilometres shifted to travel by rail, and this impacts on accidents, noise, climate change and air pollution benefits.
11 M0 Budapest Ring Road (eastern section) in Hungary

11.1 Project characteristics

The M0 Eastern Sector is the eastern component of the Budapest orbital motorway, whilst the M31 is a linking motorway between it and the M3 (the motorway to the north east of Hungary). The project has important international, national and local dimensions. Budapest sits on the junction of three land based Helsinki corridors, is the focus of the national transport network and is the economic centre and capital of Hungary. Congestion in the city centre, particularly in the vicinity of the Danube is severe. This project therefore performs an important function in facilitating the movement of international and national traffic while also providing some traffic relief to Budapest. It also forms part of the Hungarian national transport strategy. The specific objectives of the project include reductions in travel times and transport costs for this traffic and a reduction in external costs (safety and environment costs) on the existing road network.

The project comprises of 38.7 km of motorway to the east and northeast of Budapest. This motorway is Dual 2 lanes throughout, though the southern section of it has been constructed with provision for upgrading to Dual 3 lanes at a later date. In accordance with Hungarian law, no vignette or toll charges are payable on the M0 or M31. This is because they form part of an orbital motorway around an urban area.

The total aggregate cost of the project was €367m of which €319m is eligible for Cohesion Fund contributions. The EC will contribute €271m, which represents 85% of the eligible project costs. The M0 Eastern Sector opened in September 2008, whilst the M31 opened in July 2010.

11.2 Ex post CBA

11.2.1 Results of analysis

The tables below show the results of the ex post analysis. The ‘central’ scenario reported is that corresponding to the economic, demographic and transport related plans for the Budapest region up until 2020. Taking a conservative approach traffic levels and travel times are then assumed to remain static until the end of the 25 year evaluation period. As can be seen from the headline economic results in this table, the project represents high value for money with a benefit cost ratio of 5.6 and an IRR of 24.8%.
There is some uncertainty associated with this estimate. The primary reasons for this is uncertainty in future economic and traffic growth, uncertainty regarding the value of small time savings and uncertainty regarding the value of reliability. Our tests on the margins of error introduced by these uncertainties indicate that the NPV is robust to them. We have estimated a range for the NPV between €79m and €1,572m.

**Table 38. Summary of ex post economic analysis (2002 prices and values)**

<table>
<thead>
<tr>
<th></th>
<th>Central case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Present Value (€m)</strong></td>
<td>974.1</td>
</tr>
<tr>
<td><strong>Economic IRR (%)</strong></td>
<td>24.8%</td>
</tr>
<tr>
<td><strong>Benefit-cost ratio</strong></td>
<td>5.6</td>
</tr>
</tbody>
</table>

Source: Own calculation  
Note: 25 year economic life, Discount rate: 5.5%

**Table 39. Summary of ex post financial analysis (2002 prices)**

<table>
<thead>
<tr>
<th></th>
<th>Central case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Financial Net Present Value – Investment (€m)</strong></td>
<td>-219.9</td>
</tr>
<tr>
<td><strong>Financial IRR – Investment (%)</strong></td>
<td>n.a.</td>
</tr>
<tr>
<td><strong>Financial Net Present Value – Capital (€m)</strong></td>
<td>-48.5</td>
</tr>
<tr>
<td><strong>Financial IRR – Capital (%)</strong></td>
<td>n.a.</td>
</tr>
</tbody>
</table>

Source: Own calculation  
Notes: 5% discount rate, 25 year appraisal period

### 11.2.2 Key aspects of the ex post evaluation

- **Sources of benefits.** The total benefits for this project are estimated to be €1,187m. This level of benefit is almost entirely driven by travel time savings. Accident savings are about 8% of the value of the time savings. As the project increases average trip distance by routeing traffic around Budapest vehicle operating costs increase causing a disbenefit. These ‘costs’ are of the same size as the accident benefits (i.e. have a magnitude of 8% of
the time savings) and therefore almost exactly cancel out the accident benefits. Environmental costs and benefits have not been monetised in the CBA.

- **Wider impacts (addresses “Costs and benefits that cannot be expressed in monetary form”).** The M0 Eastern Sector and M31 are youthful in terms of their age and their expected economic life. The M0 opened 2 years ago and the M31 four months ago. As such their impacts on society and the economy are limited as it takes time for direct transport benefits to feed through into other markets from the transport market. Additionally, the recession has affected the economy throughout the period the M0 has been open. Primarily as a consequence of their youthfulness quality of life benefits/costs (accessibility, air quality and noise disturbance) are those most readily observable. Accessibility benefits have been included in the CBA, though environmental benefits have not. There has, however, been some economic development along the M0 corridor (retail and logistic centres) and it is expected that more will occur, as municipalities are zoning more land in the locality of the M0.

- **Meeting environmental requirements.** The project was subject to a detailed environmental impact study and the granting of an environmental permit. It is estimated that 2% of project costs (€9.2m) are associated with meeting mitigating environmental impacts. The granting of an environmental permit is a complex process in Hungary which requires negotiation on the alignment and design standard between the transport authorities, local authorities (who wish to maximise accessibility benefits and minimise adverse impacts) and the environmental authorities (who wish to minimise the impact on the environment). There is no obligation on the environmental authorities to take account of the CBA in the granting of the environment permit. This permitting process invariably delays construction and can lead to alterations in design away from the most efficient solution advocated by a CBA. For the M0 these negotiations led to changes in the location of intersections, alignment and the construction of pedestrian and vehicle bridges.

- **Utilisation.** It is estimated that the M0 is currently operating at just under 50% utilisation. By 2020 it is expected to be operating at 70% of capacity.

- **Unit costs.** Unit cost data at Levels 1, 2 and 3 were provided. (see the case study annex for the detail).

- **Main project risks and consequences.** The main risks to the ex post CBA are due to lower than expected economic growth and some uncertainty in the valuation of time savings (including reliability).
Lower than expected economic growth would imply that benefits per vehicle will be less and this in combination with less vehicles travelling means that aggregate benefits will also be less than has been anticipated.

Given that a substantial proportion of the benefits is attributed to de-congestion benefits to non-motorway traffic, and in the main the travel time savings received by this traffic is small (< 5mins), the value that small time savings has becomes important to the measurement of total scheme benefits. There exists a debate regarding the value of such small time savings and it may be the case that these benefits do not transfer through to the wider economy, as larger time savings would have done. A sensitivity test excluding benefits to non-motorway traffic indicates that whilst the NPV is substantially reduced it is still positive.

Reliability benefits have not been included in the ex post analysis due to the technically challenging nature of the task. It might be expected that such benefits could prove important given the congested and unreliable (in terms of travel time variability) nature of the Budapest road network. Sensitivity tests to these risks indicate that the project is in a worst case scenario still expected to deliver a positive economic return. If reliability benefits are included the NPV may increase by about 50%.

Accompanying actions (addresses “The contribution of accompanying actions which are outside the project but intended to enhance the project success”). The M0 Eastern Sector and the M31 are part of a co-ordinated national transport investment strategy. They contribute in two ways to this strategy. Firstly, they form part of the strategy that is aimed at developing a national Expressway network based on motorways. Secondly, in conjunction with M0 North they provide additional road capacity in the Budapest region to allow the closure and rehabilitation of each of the Danube bridges in Central Budapest. A Driver Information System has also been installed. This provides real time journey information to drivers, informs drivers of incidents and allows the highway authorities to monitor the road network. Furthermore the system installed is compatible with that used elsewhere in Hungary for the electronic enforcement and charging of the vignette (though no vignette is payable on the M0 or the M31).

Unintended effects. No unintended effects were identified, aside from some complaints about noise and visual intrusion impacts in areas where mitigation measures should have prevented them (e.g. one location in the Csömör municipality).
11.3 **Ex ante CBA**

11.3.1 **Results of analysis**

The table below shows the results of ex ante analysis. As can be seen from this table the ex ante estimate indicates the project offers good value for money. It can also be seen however that the ex post analysis is suggesting a slightly lower NPV, but a higher BCR and IRR than the ex ante did.

**Table 40. Summary of ex ante economic analysis (2002 prices and values)**

<table>
<thead>
<tr>
<th></th>
<th>Ex ante</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Present Value (€m)</td>
<td>1,177.5</td>
</tr>
<tr>
<td>Economic IRR (%)</td>
<td>16.1%</td>
</tr>
<tr>
<td>Benefit-cost ratio</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Source: Ex ante - Jacobs(2004 Table8-5 p.97); Ex post - own calculation
Note: 25 year economic life (ex ante and ex post), Discount rate: 6% (ex ante), 5.5% (ex post)

11.3.2 **Key aspects of the ex ante CBA**

- **Quality of analysis** *(addresses “Validity of assumptions made during the ex ante analysis”)*. We have reviewed the methodology used to develop the economic and financial analysis and in our view it is consistent with good appraisal practice. It is systematic and objective. If there is one weakness to the method adopted it is that no account of the traffic induced by the project has been made. The economic and financial analysis was also audited and approved by COWI on behalf of the Hungarian authorities.

- **Ex ante risk analysis** *(addresses “An examination of the ex ante risk assessment and review of the actual risk bearers, given the actual outcomes during project implementation”)*. The ex ante risk assessment involved five sensitivity tests. The first of these tests looked at a construction cost overrun of 20%, whilst three others focussed on uncertainty in the marginal values of time and accidents used to calculate the economic benefits. The final test used a higher discount rate of 10%. The ex ante risk analysis did not cover the actual risk bearers particularly well. With the benefit of hindsight the analysis should also have included an assessment of the risk of:
  - The impact on travel demand of lower than anticipated economic growth;
The impact on travel demand of not completing some of the other transport projects in the immediate vicinity – as these affect the demand for the M0;

Time overruns – the M0 opened almost a year later than planned and the M31 opened 2.5 years later than planned.

Investment cost under spend.

11.3.3 Role of ex ante CBA

The ex ante CBA that was presented in the application form for Cohesion Funds had only one purpose which was to obtain European funding. This is because the M0 Eastern Sector and the M31 had already been granted its building permit and its environment permit. This CBA however was only the latest in a whole series of feasibility studies on the M0 dating back to 1991. These earlier feasibility studies considered different alignments and designs for the motorway.

Whilst it is clear that within the transport authority CBA can be an integral part of project prioritisation, choice of preferred alignment and project design, the transport authority is restricted to implementing the infrastructure set out in Hungarian Law. It is not clear what role that CBA plays in determining which future projects appear on the statute books and which do not.

The nature of the planning process in Hungary is that an environmental permit is needed before construction can begin and the environment authorities do not take the CBA into account. Complex negotiations therefore occur between the transport authority, the environment authority and local government institutions. The result can lead to time and cost overruns as well as the choice of a sub-optimum standard from the perspective of a CBA. The State Audit Office in Hungary has criticised the form of this planning process for these very reasons.

11.4 Comparison of ex ante and ex post CBA

This section describes the main reasons underpinning the differences between ex ante and ex post CBA.

- **Discount rates.** The discount rate used in the ex post (5.5%) is lower than that used in the ex ante analysis (6%). Both are however of the same order of magnitude and would be regarded as risk free discount rates based on social time preferences. They are both therefore consistent with current CBA methods.

- **Differences between economic and financial NPV.** The two main reasons for the difference between the ex ante and ex post results are differences traffic demand and capital cost. Primarily as a consequence of
the recession travel demand is approximately 14% lower today than was predicted in 2004. This means that travel delays in the Do Minimum scenario are not as large as was predicted in the ex ante and benefits per vehicle travelling are therefore smaller than was predicted in the ex ante. Furthermore less vehicles are getting these benefits ex post than were predicted in the ex ante. The PVB of the project is therefore smaller than was predicted in the ex ante. However, as the outturn investments were €125m less than were predicted in the ex ante this compensates to some extent the reduction in benefits. Due to these competing effects the NPV has reduced but the BCR and IRR has increased compared to the ex ante.

- **Time and cost overruns.** As discussed above there were no cost overruns. In fact the tendered work costs for the project were much lower than estimated by about €125m, so the whole project cost about 25% less than was originally anticipated. The M0 Eastern Sector opened about 9 months later than was originally anticipated as a consequence of delays in procuring the land. The M31 opened about 2.5 years later than was originally anticipated as a consequence of it being excluded from the funding application in the first instance (as the whole project was expected to cost too much), but was then re-included into the application once it became apparent there would be a cost under spend.
12 Conclusions

12.1 Preliminary observations

As noted above, the objective of this Second Interim Report is to present the results of each of the ten ex post evaluations, to inform further discussion both internally within the study team and at Steering Group level. At this stage, we have not yet attempted to identify unifying themes and general conclusions, which will be discussed, along with recommendations about the evaluation methodology and the future role of CBA, in the Final Report.

This notwithstanding, at this stage we offer some observations based on our experience with the evaluation of the ten case studies. Some of these results confirm the preliminary findings we had identified when carry out the evaluation of the Pilot Case Studies.

- **Satisfactory ex post benefit-cost ratio.** Overall, projects have so far delivered positive NPVs and benefit-cost ratios higher than 1. This means that in almost all cases the benefits of the project exceed its costs. The only exception is the LAV Madrid-Barcelona for which the benefit-cost ratio is just below one. We note however that the project is not yet completed, as the last section (Barcelona – French Border) will become fully operational only in 2013.

- **Road projects vs. rail projects.** Generally, road projects tend to yield higher benefit-cost ratios than rail projects. However, this difference is due to the specific nature of rail projects, which normally require higher levels of capital investment. This result therefore should not be interpreted as an indication that road projects are always preferable to road projects. The core CBA offers only a partial assessment of the full impact of a project and does not take into account all the factors that may make a rail investment preferable to a road one.

- **Elapsed time since opening.** The majority of the projects we have reviewed opened relatively recently, in some cases as late as the end of 2009. The short elapsed time since project opening raises two issues with the ex post evaluation:
  - while we obtained outturn information on project costs, we needed to make assumptions about future traffic levels. In the absence of historical traffic data, this has led to a high degree of uncertainty in the calculation of project benefits, especially in the context of the current global economic downturn; and,
with the exception of very large infrastructure projects (such as the high speed railway line between Madrid and Barcelona), wider impacts generally take a significant period of time to emerge. For this reason, our analysis might have not considered effects that will materialise only in future.

- **Identification of wider impacts.** The lack of project monitoring frameworks, implemented at project opening, makes the identification of wider impacts particularly challenging. This is especially the case for projects being implemented as part of a wider modernisation strategy, against a backdrop of rapid economic growth in the early 2000s and infrastructure investments. In these cases, identifying a causal link between a project and wider socio-economic impacts is challenging.

- **Wider impacts come predominantly from new infrastructures.** In terms of wider impacts, there is a significant difference between new infrastructures and upgrades of existing infrastructures. With regards to new infrastructures, socio-economic impacts tend to be significant and more easily identifiable, even anecdotally. With regards to upgrades, most of the benefits originate from time savings and vehicle operating costs savings, and from benefits caused by improved road safety. These impacts tend to be fully captured in the application of the standard CBA analysis.

- **Co-ordination of different groups of stakeholders.** As identified in the First Interim Report, we found that the number of stakeholders involved with a project can delay their engagement with the study and the provision of information. This is particularly the case for rail projects, some of which had been implemented by the national railway company before the unbundling of network and train operations. This implies that the information underpinning the ex ante analysis may be split between two different companies.

- **Loss of institutional memory.** In terms of planning and design, most of the projects we have considered in this study date back to the late 1990s. This was also the time when sponsoring organisations carried out their first comprehensive cost-benefit analyses. Due to the time elapsed, some of the institutional memory regarding the ex ante analyses has inevitably been lost. This issue is likely to be more significant for the evaluation of earlier projects.

Conclusions
Annexe 1: The ‘Rule of Half’

In transport appraisal, user benefits are often estimated by considering the change in consumer surplus before and after the introduction the project. Consumer surplus is the benefit that a transport user enjoys over and above the costs incurred to travel. Total benefits can be estimated by aggregating the change in consumer surplus across all users, existing and new.

If a reduction in transport perceived costs does not change the demand for transport (that is, if there are no new users), existing users will continue to consume the same ‘amount’ of transport at a lower costs. They will benefit from the full reduction in perceived cost.

However, in most cases, a reduction in travel costs (for example, a reduction in total travel time\(^7\)) leads to an increase in demand. New users will join existing ones. In this case, it would be inappropriate to assume that all users benefit equally. While existing users will benefit from the perceived costs reduction in full (they will travel at a lower cost), new users will also incur the cost of travelling, which they were not incurring before.

The figure below provides an illustration. Let us assume that, before the project, the unit cost of travelling was \(C\). Given the demand curve, we assume that the total number of passengers was \(Q\). After the intervention, travel time falls. This is equivalent to saying that the unit cost of each trip falls to \(C'\). Assuming that the demand curve does not change, this reduction in travel costs leads to an increase in the number of passengers, to \(Q'\). The shaded area in the chart shows the increase in consumers’ surplus following the reduction in travel costs and the increase in the volume of trips. This shows that the increase in consumers’ surplus is not the same for both existing passengers and new passengers. For existing passengers, the increase in consumers’ surplus is equal to the area of the rectangle defined by CEEDC. For new passengers, this is equal to the area of the triangle DEE’’. This is because new passengers bear the new cost of travelling, with partially offsets the time saving benefits.

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\(^7\) In transport economics, travel costs are expressed using the concept of ‘generalised cost’. This is the sum of ‘monetary’ and ‘non-monetary’ costs. Ticket, operating costs, fuel and wear & tear are examples of ‘monetary’ costs. Time is an example of a ‘non-monetary’ costs. ‘Non-monetary’ costs are turn into a monetary value using appropriate parameters such as the value of time. In the example above, a reduction in travel time is equal to a reduction in travel cost.
Therefore, the increase in consumer surplus (the shaded area), can be calculated using the following formula. This is known as the ‘Rule of Half’, as new passengers only benefit from half the reduction in cost compared to existing passengers.

\[ \Delta \text{Consumers' surplus} = (\text{Change in cost} \times \text{existing passengers}) \]
\[ + (\text{Half change in cost} \times \text{new passengers}) = \]
\[ = (C - C') \times Q + \frac{1}{2} (C - C') \times (Q' - Q) = \]
\[ = \frac{1}{2} (C - C') \times (Q + Q') \]

While assuming a linear demand curve may be a simplification of the actual preferences of transport users, this is an approach commonly accepted and used in transport appraisal. We have applied it in the pilot projects presented in this report.

Annexe 1: The ‘Rule of Half’
Annexe 2: Semi-structured stakeholders interview

This Annexe provides an illustration of the stakeholder interview guide we have developed to support our meetings with representatives of various organisations at Member State level.

Objectives of the stakeholders interview

The main objectives of the stakeholders interviews are the following:

- to provide stakeholders consulted with an overview of the study process and key themes to be investigated as part of the study;
- to understand the broad processes, approaches and assumptions used in the scheme cost benefit analysis prepared to support previous (and current applications) for EU cohesion funds;
- to understand the view of member states on the effectiveness, usefulness and importance of ex ante CBA at the time of application compared to current processes prescribed in the EU’s own guidance on CBA approaches for major projects;
- to obtain views from relevant parties involved in CBA for transport infrastructure projects regarding how the process could be further improved to enhance its usefulness in the decision making process;
- to inform the E.U’s understanding of issues affecting the ‘reliability’ of CBA analysis supporting applications for cohesion funding; and,
- to assist the study team in measuring the magnitude of expected and unexpected scheme impacts through a process of ex-post evaluation (costs and benefits).

Summary of key lines of enquiry

Introduction

The section that follows lists some of the key lines of enquiry we intend to follow as part of stakeholder interviews with stakeholders. The points listed are intended to ensure that we tackle the study requirements set out in the terms of reference and provide a degree of consistency between interviews. Questions will be broadly set around the following themes:
Theme 1: Processes, approaches and methodologies used in the ex-ante CBA adopted;

Theme 2: Understanding the effectiveness, usefulness and importance of CBA in the decision making process associated with cohesion fund applications;

Theme 3: Identification of measures to enhance approaches to CBA and its usefulness;

Theme 4: Issues affecting the reliability of ex ante CBA analysis;

Theme 5: Identification of out-turn (actual) scheme impacts (expected or unexpected); and,

Theme 6: Identification of wider anecdotal scheme impacts.

The text that follows is intended to provide an indication of the key lines of enquiry likely to be pursued in stakeholder interviews. Not all questions will be relevant to each stakeholder, therefore this document should only be used to provide an indication of the broad lines of inquiry required to elicit the views necessary to fulfil the requirements in the Terms of Reference.

Processes, approaches and methodologies used in the ex-ante CBA

Who was responsible for setting the scope of the CBA analysis and how was this determined? What were the main drivers for choosing particular schemes to be subjected for CBA analysis?

Who was responsible for undertaking the technical aspects of the CBA? Were they audited? How often and by whom? What issues have arisen regarding the accuracy of CBA results presented?

Who were the main bodies involved in the application process? How were they involved? More specifically, which aspects of the CBA/business case development were they most interested in?

What level of support did you receive from the EC during the period within which you were preparing your application?

Did you draw upon any published CBA guidance to inform the preparation of the scheme business case? If so, what was the source? Was guidance adequate? For example did you largely follow your own national CBA technical methodologies or those prescribed by the EU at the time of
application? For which type of analysis did you use national values or wider international values?

- To what extent did the final CBA submitted to support cohesion funding application align to more recently published CBA guidance issued by the EC (2008)?

- Are you able to provide any information that you feel may help to explain any differences between projected and out-turn scheme costs and forecasts?

- To what level of detail were forecast scheme costs provided? Who is responsible for monitoring costs and how can this information be made available to the study team.

- Was the scheme delivered according to schedule and cost? If not, what were the main factors influencing differences between forecasts and out-turn impacts?

Understanding the effectiveness, usefulness and importance of CBA in the decision making process

- To what extent does your state use CBA analysis to make comparison with alternative scheme options? For example: a low cost alternative, different route alignments, alternative schemes elsewhere on your national network.

- Which aspects of CBA were most useful in determining the preferred option and why? Do you feel that the balance of analysis presented in more recent CBA guidance is about right or could be improved?
  - Journey time savings;
  - Traffic Forecasts;
  - Environment Impacts;
  - Assessment of wider economic benefits (impact on business activity and national GDP) and policy objectives;
  - Scheme Cost;
  - Risk Analysis;
  - Present Value of Benefits;
  - Benefit Cost Ratio, Internal Rate of Return; and,
What performance indicators were most important to the decision maker? Does the importance of various indicators vary according to whom is making a decision?

What was the extent of the involvement of the signatory (the final applicant) in the preparation of CBA?

What type of decisions was the CBA designed to support?

- EC decision on funding;
- Member state decisions on:
  - Choice between route options?
  - Choice between other projects?
  - Prioritisation of projects?
  - Timing?
  - Go ahead or not?
  - Value for Money?

At what stage in the development of the project was CBA used and how was it used? Option generation? Does the level of CBA adopted vary according to each stage of the scheme development?

Identification of measures to enhance approaches to CBA and its usefulness

On the whole, to how important/useful or CBA process with regard to the cohesion fund applications? In your view, what are the key strengths and weaknesses of historical and current CBA methods adopted by funding applicants?

Would you say the CBA process required to support cohesion fund applications is too restrictive, about right or not prescriptive enough?

Do you feel the requirements for CBA set by the EU and the level of resource (staff time) required to meet EC criteria is proportionate to application process, for example: do you feel the application process involves too much CBA? Not enough CBA?

Do you think the level of technical advice (written or verbal) provided by the EC with regard to CBA of transport projects is adequate or could be
improved? Which of the current requirements are most useful (EC CBA checklist?)

- Which specific aspects of CBA (technical or process) would you like to see improved or think further guidance or research would be useful?
- Which specific aspects of CBA (technical or process) do you think represent best practice?
- To what extent do you feel ex-post evaluation offers opportunity to improve ex ante CBA methods?

Issues affecting the reliability of ex ante CBA analysis

- Are there specific elements of the CBA process that you think are unreliable and may be adversely affected decisions made by the EU and others users of cohesion funding CBA?
- Do you have any ‘real’ or ‘anecdotal’ evidence regarding the actual impacts of the scheme in terms of:
  - Utility – level of use
  - Accident impacts
  - Journey time savings;
  - Traffic Forecasts – in your view has the scheme had the anticipated effects on traffic?
  - Environment Impacts
  - Assessment of wider economic benefits (impact on business activity and national GDP) and policy objectives
  - Scheme Costs
  - Risk Analysis – did any of the identified risks emerged? Were the impacts worse or better than expected?
  - Present Value of Benefits
  - Benefit Cost Ratio, Internal Rate of Return;
- Have the impacts of the scheme broadly met expectation? What differences might potentially be identified as part of the ex-post evaluation and why?
- Do you think there are aspects of the CBA that could have been more accurately assessed with better guidance or technical understanding of CBA?
Identification of actual scheme impacts (expected and unexpected)

- In addition to the scheme proposals set out in the CBA documents already provided, have there been any further improvements along the corridor (subsequent to the cohesion funding application) that may affect scheme impacts identified as part of this ex post evaluation study?

- Based on the methodology presented, do you have any views on how our evaluation approach could be enhanced, bearing in mind our overall budgetary constraints?

- Do you have any additional information that will help support our evaluation that has not already been provided to the study team?

- Are there additional issues that you think need to be considered in our evaluation process? Specific environmental, safety or traffic issues?
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