Transport

TASK 3 - MAJOR PROJECT CASE STUDIES

WORK PACKAGE 5

Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF)

May 2016
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# Table of Contents

1 **Poland: Modernisation of railway line E30/C-E 30, Kraków – Rzeszów section, Phase III** ........... 3  
   1.1 Case study summary .................................................................................................................. 3  
   1.2 Introduction .............................................................................................................................. 4  
   1.3 Project context and implementation ....................................................................................... 7  
   1.4 Demand analysis ...................................................................................................................... 11  
   1.5 Financial analysis .................................................................................................................... 13  

2 **Poland: A1 Toruń - Stryków** .................................................................................................. 17  
   2.1 Case Study Summary ............................................................................................................... 17  
   2.2 Introduction ............................................................................................................................ 18  
   2.3 Project context and implementation ....................................................................................... 22  
   2.4 Demand Analysis .................................................................................................................... 26  
   2.5 Financial analysis .................................................................................................................... 28  
   2.6 Lessons Learnt ......................................................................................................................... 32  

3 **Romania: Motorway Construction on TEN-T 7, Cernavodă - Constanța Section** ................. 34  
   3.1 Case study summary ............................................................................................................... 34  
   3.2 Introduction ............................................................................................................................. 35  
   3.3 Project context and implementation ....................................................................................... 37  
   3.4 Demand analysis ..................................................................................................................... 40  
   3.5 Financial analysis ..................................................................................................................... 44  

4 **Romania: Rehabilitation of national road DN6 Alexandria – Craiova** .................................... 48  
   4.1 Case study summary ............................................................................................................... 48  
   4.2 Introduction ............................................................................................................................. 49  
   4.3 Project context and implementation ....................................................................................... 52  
   4.4 Demand analysis ..................................................................................................................... 55  
   4.5 Financial analysis ..................................................................................................................... 59  

5 **Bulgaria: Trakia Motorway Bulgaria (Lots 2, 3 and 4)** ............................................................ 62  
   5.1 Case study summary ............................................................................................................... 62  
   5.2 Introduction ............................................................................................................................. 63  
   5.3 Project context and implementation ....................................................................................... 65  
   5.4 Demand analysis ..................................................................................................................... 69  
   5.5 Financial analysis ..................................................................................................................... 72
6 Czech Republic: Track modernisation Votice to Benešov u Prahy .......................................................... 76
   6.1 Case study summary ......................................................................................................................... 76
   6.2 Introduction ........................................................................................................................................ 77
   6.3 Project context and implementation ............................................................................................ 80
   6.4 Demand analysis ............................................................................................................................ 83
   6.5 Financial analysis ............................................................................................................................ 84

7 Germany: Leipzig City Rail Tunnel (Modules 5 and 6) ......................................................................... 87
   7.1 Case study summary ......................................................................................................................... 87
   7.2 Introduction ........................................................................................................................................ 87
   7.3 Project context and implementation ............................................................................................ 92
   7.4 Demand analysis ............................................................................................................................ 95
   7.5 Financial analysis ............................................................................................................................ 97

8 Estonia: Reconstruction of Ülemiste Junction in Tallinn ................................................................. 101
   8.1 Case study summary ......................................................................................................................... 101
   8.2 Introduction ........................................................................................................................................ 102
   8.3 Project context and implementation ............................................................................................ 105
   8.4 Demand analysis ............................................................................................................................ 107
   8.5 Financial analysis ............................................................................................................................ 111

9 Spain: Madrid-Valencia-Murcia High Speed Rail ........................................................................... 114
   9.1 Case study summary ......................................................................................................................... 114
   9.2 Introduction ........................................................................................................................................ 115
   9.3 Project context and implementation ............................................................................................ 117
   9.4 Demand analysis ............................................................................................................................ 120
   9.5 Financial analysis ............................................................................................................................ 125

10 Hungary: Budapest Metro Line 4 ............................................................................................. 127
    10.1 Introduction .................................................................................................................................... 127
    10.3 Project context and implementation .......................................................................................... 132
    10.4 Demand analysis .......................................................................................................................... 136
    10.5 Financial analysis .......................................................................................................................... 140
    10.6 Lessons learned ............................................................................................................................. 145

11 Task 3 Conclusions ......................................................................................................................... 147
1 Poland: Modernisation of railway line E30/C-E 30, Kraków – Rzeszów section, Phase III

1.1 Case study summary

The Kraków to Rzeszów (Stage 3) project entailed the modernisation of 138.7 km of the railway line number 91 in the south east of Poland. The project was targeted to improve the track conditions, enabling speeds of up to 160 km/h for passenger trains and 120 km/h for freight trains; the pre-construction average speeds achieved for passenger trains were under 60 km/h for regional trains, 65 km/h for interregional trains and 70 km/h for intercity trains therefore between 90 and 100 km/h below the new target.

The E30 project was split into six separate design and build contracts, with tenders issued in late 2010. As a consequence of the procurement approach, the six appointed contractors were required to obtain in excess of 100 building permits required for the project. Construction commenced in November 2011 and is scheduled to conclude in December 2016, a 61 month duration and longer than originally forecast.

The majority of stakeholders indicated that the beneficiary had not delivered well on the E30 project. The Managing Authority therefore instigated weekly project meetings with the beneficiary to undertake enhanced monitoring of project delivery. A European Commission focused Task Force for rail was also instigated, in part due to the delays on this project.

The 2009 cost benefit analysis forecast a net present value of €284 mn and an economic benefit to cost ratio (EBCR) of 1.40. The demand forecasting and cost-benefit analysis for the project included the assumed completion and operation of the parallel A4 motorway, including the implementation of tolls for passenger and freight vehicles. Indeed, central to the selection of the preferred option was that the 160 km/h option provided the minimum speed, and therefore journey time, to make the E30 railway line competitive with the A4 motorway.

The cost benefit analysis included a series of sensitivity tests for both revenue and costs variables. For all scenarios the project was forecast to return positive economic and financial indicators, justifying the project for Cohesion Policy co-financing. However, JASPERS confirmed in consultation the view expressed in the 2010 completion note, that the economic assessment was conservative as it did not include all potential benefits. Issues omitted included freight time savings and vehicle operating costs.

The view of stakeholders was that, when completed, the E30 corridor will achieve both the regional and national objectives of connectivity, through the achievement of enhanced journey times and service quality. However, the longer than anticipated construction period, and the approach taken to deliver the project section-by-section, were considered likely to influence the ramp-up of rail demand following completion. The accuracy of the assumed relative attractiveness of the A4 and E30 route options was questioned by stakeholders, who noted that national demand on the roads had
reached levels in 2014 forecast to be achieved in 2024. Highway demand had been commonly under-estimated in project feasibility and cost-benefit analyses.

The analysis identified that the E30 project was forecast to have a negative financial profitability, as future net revenues from train operators were insufficient to offset the initial capital costs. Because the project was a public railway and therefore revenue generating, a funding gap calculation was used to identify the public expenditure required to support the project. The funding gap was estimated at 81%, demonstrating low net financial revenues.

1.2 Introduction

Introduction

This section presents the case study for the Modernisation of Railway Line E30, Kraków – Rzeszów, Stage III. Table 1.1 contains a list of the key stakeholders who were interviewed regarding the project.

Table 1.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Infrastructure and Development</td>
<td>Responsible for Poland’s national and regional development policy, managing and distributing European Union Structural and Cohesion Fund, eliminating spatial economic disparities, and promoting social and economic cohesion. The Ministry is responsible for Poland’s transportation infrastructure, including motorways, expressways, and national roads.</td>
</tr>
<tr>
<td>Centre for EU Transport Projects (CUPT)</td>
<td>Implementing body with regards to EU funds for transport under the operational programme for Infrastructure and Environment, 2007-2013. CUPT provides support to the beneficiary in the process of investment preparation and implementation of this project, to ensure that all EU funds have been reasonably and efficiently used by 2015, verifying the financial and project data they receive.</td>
</tr>
<tr>
<td>PKP PLK</td>
<td>Responsible for the management of the national rail network, alongside the management of passenger and freight trains operated by licensed operators.</td>
</tr>
<tr>
<td>JASPERS (Joint Assistance to Support Projects in European Regions)</td>
<td>Provides advice to Member States to help improve the quality of the major projects to be submitted for grant financing under the Structural and Cohesion Fund. JASPERS advised upon the project, reviewing technical documentation produced in support of the scheme.</td>
</tr>
<tr>
<td>RDOŚ</td>
<td>The Regional Directorate for Environmental Protection in the voivodeships of Rzeszów and Kraków. Has responsibility for implementing environmental policy for conservation, wildlife management and Natura 2000 sites.</td>
</tr>
</tbody>
</table>

Summary of the project

The project entailed the modernisation of the railway line number 91 in the south east of Poland, between the two urban areas of Kraków and Rzeszów (Figure 1.1). The railway line forms part of the E30/C-E30 corridor, linking the Ukraine border in the east to Germany in the west; intermediate points in Poland include Wroclaw, Katowice, Kraków and Medyka. The project was delivered with a financial contribution from the Cohesion Fund.

The project has been undertaken in order to increase the demand for passenger and freight movement (particularly between EU Member States), and improve the quality of service. The project was targeted to improve the track conditions, enabling speeds of up to 160 km/h for passenger trains and 120 km/h for freight trains. This in turn was forecast to lead to reduced journey times.

The project included the adaptation of higher standards for axle loads, the revitalisation of the tracks (including rails, sleepers, ballast), turnouts, engineering facilities, track network, signalling, power supply and telecommunication and base layer of the signalling (representing the first phase of the ERTMS programme\(^2\)). The provision of enhanced passenger facilities and station environments was also part of the project, with 11 stations modernised, 4 downgraded to halts and 1 (at Grabiny) removed.

Figure 1.1 Section map of project

![Section map of project](source)

Source: JASPERS Completion Note

Project selection

The number 91 railway line saw limited investment over the period 1985 – 2005, resulting in the quality of track being poor and consequently the presence of speed restrictions. Although the maximum operating speed was designed to be 120 km/h, the average commercial speeds achieved were under 60 km/h for regional trains, 65 km/h for interregional trains and 70 km/h for intercity trains\(^3\). The quality of the track

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\(^2\) European Railway Traffic Management System

\(^3\) Source: JASPERS completion note, December 2010.
also did not comply fully with the international requirement for inter-operability. The quality of passenger facilities at stations was also of a generally poor condition.

The initial project scope assessed in the 2007 Feasibility Study included the modernisation_upgrade of the 91 railway line between Medyka on the Ukraine border to Kraków. The Feasibility Study considered the following design options:

- Option 0: A non-investment option, where the existing capacity and standards would be maintained;
- Option 1: The rehabilitation of the infrastructure to ensure that the designed performance of 120 km/h could be achieved;
- Option 2: The modernisation of the infrastructure, increasing the maximum speed to 160 km/h for passenger trains; and
- Option 3: As the above option with 12 level crossings replaced by grade-separated solutions.

Option 2 was selected on the basis of the cost and benefit implications. As explored further later, the demand forecasting and cost-benefit analysis for the project included the assumed completion and operation of the parallel A4 motorway, including the implementation of tolls for passenger and freight vehicles. Indeed, central to the selection of option 2 was that the 160 km/h option provided the minimum speed, and therefore journey time, to make the E30 railway line competitive with the A4 motorway. It was noted by JASPERS that the analysis was based on trips for the section of the E30 route between Kraków and Tarnów, not the full length between Kraków and Rzeszów; demand data showed that the vast majority of trips were only using sections of the route (where 160 km/h still provided sufficient benefit above the A4).

Following the Feasibility Study, and prior to the submission of the Application Form, the decision was made to focus on the sections between Kraków and Rzeszów, with the works split into two stages:

- Kraków to Tarnów upgraded to 160 km/h; and
- Tarnów to Rzeszów upgraded to 160 km/h.

The rationale provided at the time of application for focusing on these sections was that they were more heavily populated, and had the higher existing and potential passenger traffic, than the Rzeszów to Medyka section. The resulting project therefore included 138.7 km of the E30 railway line.

A further option considered at the feasibility stage but not included in one of the detailed options was the modernisation of the track to carry 200 km/h tilting trains. However, stakeholders confirmed that due to the lack of guaranteed operators for

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4 The option numbering has followed that presented in the JASPERS completion note as this followed the numbering convention through the inclusion of an option 0 do-nothing scenario.
such high speed trains, and the higher relative costs, this option was not taken forward in the assessment.

It was noted by JASPERS that the E30 was one of the first Cohesion Policy applications prepared by PKP PLK, and consequently the quality of the documentation was considered poor. The quality of the Environmental Impact Assessment (EIA) was a particular area of concern and resulted in DG ENV issuing an interruption letter in association with JASPERS. However, PKP have now submitted in excess of twenty applications for funding, with the latter projects being of a much higher quality in the view of stakeholders.

1.3 Project context and implementation

Objectives

The main objective of the project was to modernise the Kraków (Podliże) to Rzeszów railway line to:

- Reduce the journey time and enhance the safety and comfort of passengers;
- Reduce the journey time and enhance the quality of freight transport services; and
- Enhance the quality of the railway line 91 through removing bottlenecks, enhancing traffic control, increase the capacity and improve the competitiveness compared with other routes/modes.

Through this it was anticipated to promote economic development in the region, enhancing accessibility between the main economic centres in area, whilst minimising environmental impacts.

Policy context

The E30 project formed part of the operational programme for Infrastructure and Environment, for the programming period 2007-2013. It was also part of the 2008 Master Plan for Rail, which set out the long-term development plan for the period to 2030\(^5\). The corridor was also part of the TEN-T corridor III, which runs from Berlin, through Dresden, Zgorzelec, Wroclaw, Katowice, Kraków, Medyka and on to Kiev in Ukraine. As such, it was an important element of the National Transport Policy for Poland.

The E30 was considered by PKP and JASPERS to be a key link between Ukraine and Germany, through Poland, connecting with the E59 (via Szczecin, Poznan, Wroclaw and Chalupki) rail route. One aim was to connect Tarnów, via Kraków, with Warsaw more effectively; at the time of the application in 2010 there were two early morning trains from Kraków to Warsaw and one from Tarnów. The objective was to have a journey time of 2.5 hours from Kraków to Warsaw, and an additional 1.5 hours from Tarnów to Kraków. The total four-hour journey time was considered by stakeholders as to be the maximum in order to compete with low cost airlines.

The Ministry of Infrastructure and Development confirmed that the presence of the E30 on the TEN-T was a central factor in the decision to go ahead with the project. The TEN-T network routes were given equal consideration by the Ministry and the inclusion of the E30 in the 2007-2013 programming period was due to the status of the project i.e. progress in terms of the designs. The phasing of infrastructure investment in Poland was therefore influenced by the timescales-stage of delivery, as well as the relative importance of each corridor. The application for Cohesion Policy funding for the E30 project was essential, and there was consensus among stakeholders that the project would not have progressed without such support.

It is noteworthy that the majority of the 2007-2013 rail projects in Poland were modernisation focused, with other works including the revitalisation of track; the latter were lower cost but resulted in a lower standard railway line. The Ministry noted that the 2014-2020 programming period in Poland will have a focus on the rehabilitation of railway lines on the TEN-T, alongside the ongoing modernisation of track. The rationale for this stated by the Ministry related to the implementation challenges experienced in the 2007-2013 programming period.

**Project implementation**

The Application Form identified an anticipated start of construction in November 2010, and a completion date of January 2015; the duration of construction was therefore 51 months. However, the JASPERS completion note of December 2010 noted that construction was not due to commence until late 2011, but that January 2015 remained a realistic completion date based on the information available at the time and the assumption that the building permits could be obtained effectively; a construction period of 36-38 months. The construction period started in November 2011 and is now scheduled to complete in December 2016; a 13 km section immediately to the east of Kraków remains in construction at the time of evaluation. On the assumption that the December 2016 milestone is achieved the actual construction duration will be 61 months. The project has therefore experienced delays in its implementation.

With regards to the 13 km section of track to the east of Kraków, and the proposed completion in late 2016, the Ministry are intending to submit an application for funding from the 2014-2020 Cohesion Policy programming period to complete this element of the work. A revised Application Form will be prepared, and early autumn 2015 is anticipated for submission. This Application Form will not be for additional funding, but reflects the effective underspend in the 2007-13 programming period and the need for funding from the 2014-2020 programming period. The value of the transfer was estimated by the Ministry to be approximately €92 mn.

Eight of the nine Polish rail projects, including the E30, being delivered with Cohesion Policy funding in the 2007-2013 programming period adopted a design and build procurement arrangement. The E30 project was split into six separate design and build contracts, with tenders issued in late 2010. As a consequence of the procurement approach, the six appointed contractors were required to obtain the 100+ building permits required for the project; JASPERS highlighted this as a key risk and recommended that PKP increase the level of supervision undertaken. Through consultation with stakeholders the evaluators have noted that a major cause for
delays in delivery was the process of obtaining the necessary building permits. For example, the administrative burden of undertaking the environmental analysis for each permit generated delays, particularly as different approaches were required for publicly and privately owned land. Other causes of delay included:

- The level of public consultation required. Although the consultation activities did not generate any issues or concerns, the process of arranging and delivering the required events took longer than anticipated;
- The weather conditions were reported by contractors as a reason for delays;
- The Ministry noted that contractors were moving resources between a number of projects, of which the E30 was one, and this resulted in a failure to deliver to interim contract milestones; and
- The EIA for the project was very complex and generated delays. The EIA needed to be valid for six years which was not considered long enough by stakeholders in what can be complex and drawn out delivery programmes.

The E30 project was delivered through a red FIDIC (International Federation of Consulting Engineers\(^6\)), where the risks remained with the employer; on the E30 project the contract was signed by PKP PLK. However, PKP has, in the view of the Ministry, not performed this function well and a lot of engagement was required between the Ministry and the contractor during the construction phase.

The Ministry therefore instigated weekly project meetings with PKP to undertake enhanced monitoring of project delivery. A European Commission focused Task Force for rail was also instigated following the discussions around the request to move 2007-2013 funding from rail to road and the desire of the Commission to monitor PKP and the Ministry more closely. The Task Force consists of the Commission (DG REGIO and MOVE), Ministry, JASPERS and PKP. The scope of discussions included certification of projects, phasing of work and problem solving. This has proven useful in the view of stakeholders and will continue in the 2014-2020 programming period.

Stakeholders commented on the risks of splitting large investments into a number of staged projects, rather than completing the works in one go. The risks included greater impacts on rail demand during a more staged construction, and longer after effects due to the increased disruption. However, stakeholders noted that closing lines completely was more difficult for routes that were heavily trafficked by freight or where alternative routes were not available.

The quality of the preliminary designs prepared through the design and build contracts were poor on the E30 and provided details similar to a concept design according to

\(^{6}\) International Federation of Consulting Engineers published standard forms of contract for adoption between employers and contractors. Three levels of contract were prepared, namely The Red Book: Contract for Works of Civil Engineering Construction, The Yellow Book: Contract for Electrical and Mechanical Works including Erection on Site, and The Orange Book: Contract for Design-Build and Turnkey. The Red Book should be used where the employer has designed the scheme, whilst the Yellow Book should be adopted where a contractor design is adopted, not inclusive of maintenance regimes (commonly referred to as Design and Build contracts).
stakeholders. It was therefore not possible to complete an EIA accurately. The geotechnical costs consequently increased during construction and ground investigations were undertaken.

Another challenge during project implementation identified by stakeholders that that the Terms of Reference for contractors were too high level and not detailed enough to control potential risks. The costs of initial bids were therefore low, with subsequent cost escalation. It was noted by stakeholders that the Terms of Reference for more recent projects were of a more detailed nature, with more interim milestones; this was specifically identified to prevent contractors working to long end-dates and moving resources between projects.

Stakeholders also noted that the project development and delivery activities associated with each of the Cohesion Policy programming periods was a contributory factor in observed financial/cost issues. Following the preparation of operational programmes, it was observed by stakeholders that Member States work through a process of project feasibility, preliminary/detailed design, tendering and finally construction. This resulted in periods, particularly in the early parts of a programming period, where construction activity is low. Consequently, the market declines, some construction firms go out of business and the options when projects reach the construction phase are lower. Those firms that remain operating also offer low tender prices during later periods of activity to ensure they secure work.
1.4 Demand analysis

Review of assumptions

The economic and financial appraisals of the E30 project were heavily dependent on the forecast demand: the number of passengers using the scheme. A high level summary of the demand analysis carried out for the E30 Railway Line is shown in Table 1.2.

Table 1.2 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
<th>The reliability of demographic assumptions has been questioned by stakeholders, due to the nature of the regional population.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited evidence of consideration of demographics in demand analysis.</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
<th>The inclusion of the A4 was an important consideration, given the parallel nature of the routes. The level and timing of abstraction/mode shift between the two modes was robust. The forecasting included the temporary loss of rail passengers following the completion of the A4, and the subsequent return of passengers following modernisation. The forecasts were generally in line with those from the A4 motorway project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand analysis considered highway and rail modes, in particular the parallel construction of the A4 motorway. The Feasibility Study examined four options relating to reconstruction, rehabilitation or modernisation of the existing rail line.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer Behaviour Summary</th>
<th>Scoring</th>
<th>The consumer behaviour methodology for journey time included factors for car access, ticket purchase, access to the station, and factors for journey costs included ticket price, value of time and vehicle operating costs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand analysis was undertaken using a model, which assumed the parallel construction of the A4 motorway. Two segments of passenger traffic were assessed (inter-regional and regional). The modal split was calculated based on the generalised journey cost, with different values of time for passenger segments.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability/Tariffing Summary</th>
<th>Scoring</th>
<th>The information used on fares was accurate and reflected the approach to establishing fare levels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tariffs were determined nationally and were fixed. No consideration was presented relating to the affordability of these fares.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

**Verification of assumptions**

The level of demand forecast to use the E30 was reported as the total number of passengers (thousands/year). The do-nothing option 0 included a continued decline in the forecast demand for rail to 2015, followed by a gradual increase through to 2039 (Table 1.3). The preferred option 2 was forecast to generate a steady increase in passenger flows, to a point in 2039 where the flow would be more than double that forecast in option 0.

<table>
<thead>
<tr>
<th>Table 1.3 Demand forecast passenger flows (1,000’s per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Option 0</td>
</tr>
<tr>
<td>Option 1</td>
</tr>
<tr>
<td>Options 2+3</td>
</tr>
</tbody>
</table>

Source: Cost benefit analysis

No outturn data was available to the evaluators, in part because the project was considered by stakeholders not to be completed until the section east of Kraków was completed. As such, stakeholders felt that it was too early and not appropriate to analyse quantitative data on passenger and freight flows. However, extensive discussions were held with stakeholders regarding the anticipated results and the accuracy of the forecasts.

The view of JASPERS was that, when completed, the E30 corridor will achieve both the regional and national objectives of connectivity, through the achievement of enhanced journey times and service quality. However, the longer than anticipated construction period of the E30, and the approach taken to deliver the project section-by-section, were considered likely to influence the ramp up of rail demand following completion. The view of stakeholders was that this could take 6-12 months longer than originally forecast. JASPERS commented that PKP were now more aware of the ramp up effect than before, and that this is now being forecast more accurately. Furthermore, the key to the forecast rail demand was the relative journey time between the A4 and the E30.

The regional authority stakeholders noted that companies had been established to operate minibuses along the A4 motorway since it opened, offering a near door-to-door service to travellers. The rationale for these companies was that sections of the railway line remained closed resulting in people shifting mode/route to the A4 which remained toll free at the time of evaluation; although tolls were included within the A4 application, the view of stakeholders was that this would not be implemented before 2017.

The accuracy of the assumed relative attractiveness of the A4 and E30 route options, as well as the accuracy of demand forecasting in general, was questioned by stakeholders, who noted that national demand on the roads had reached levels in 2014 forecast to be achieved in 2024. Highway demand had been commonly underestimated in project feasibility and cost-benefit analyses, in part due to the quality of demographic forecasts. There was no consensus on the potential impact such a systematic bias would have on the forecast demand for the E30 and other rail modernisation projects in Poland. However, if this bias was due to underlying...
population/demographic assumptions, the same impact would be expected for rail projects and the level of competition between modes would remain as forecast.

Concerns were raised by one stakeholder organisation regarding the accuracy of the demographic assumptions included in the E30 assessment. The two voivodeships through which the E30 runs were considered to contain a population that was more socially mobile than the average for Poland, for example with a higher GDP per capita than other regions. This, it was suggested, would generate higher travel demand and a greater willingness to pay for travel than was estimated in the cost benefit analysis. The use of national demographic growth and travel demand assumptions can be considered a systematic bias in Poland, during the 2007-13 programming period.

Finally, stakeholders noted that the frequency of trains on the E30 had not been accurately forecast. Both voivodeships indicated a desire to increase the frequency of trains on the E30 post modernisation. However, such service enhancements were not included in the business case, which could again have resulted in demand being underestimated. It is understood from the consultation that had happened because it had not been possible to identify a source of funding for the additional services when the business case was being prepared.

1.5 Financial analysis

Overview of financial analysis

Table 1.4 presents the project costs (inclusive of VAT) and Cohesion Fund contribution, for the application in 2010 and an updated cost provided by the Ministry in 2015. Stakeholders commented that the forecast costs in 2010 were ~10% higher than the contracted values, with the majority of the design and build contracts coming in under the original forecasts; this was a systematic bias observed across many case studies. There was consensus that the economic recession was the key factor in determining the bid costs, and despite subsequent cost increases the 2015 forecast was still below the 2010 value.

Table 1.4 Cost of E30 project

<table>
<thead>
<tr>
<th>Stage</th>
<th>Cost € b</th>
<th>Cohesion Fund Contribution € b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application form 2010</td>
<td>1.13</td>
<td>0.48</td>
</tr>
<tr>
<td>Forecast cost 2015</td>
<td>1.02</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Source: Application form and stakeholder consultation

Table 1.5 presents the project’s financial structure, exclusive of VAT, showing that the scheme was heavily reliant on Cohesion Policy support for the majority of funding (52%). The EIB loan was secured to address the funding gap post construction.
### Table 1.5 Contributions to cost of E30 project

<table>
<thead>
<tr>
<th>Source</th>
<th>€ b</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion Fund</td>
<td>0.48</td>
</tr>
<tr>
<td>Polish State</td>
<td>0.27</td>
</tr>
<tr>
<td>EIB loan</td>
<td>0.17</td>
</tr>
<tr>
<td>Total Budget</td>
<td>0.92</td>
</tr>
</tbody>
</table>

Source: Application form

### Economic analysis

The JASPERS completion note (2010) confirmed that the economic analysis has been undertaken in-line with the European Commission guidance for CBA, as well as the Blue Book for Railway Infrastructure and Rolling Stock Projects. Three options were assessed in terms of the Economic Rate of Return (ERR):

- Option 1: The rehabilitation of the infrastructure to ensure that the designed performance of 120 km/h could be achieved;
- Option 2: The modernisation of the infrastructure, increasing the maximum speed to 160 km/h for passenger trains; and
- Option 3: As the above option with 12 level crossings replaced by grade-separated solutions.

In overall economic terms, the 2009 cost benefit analysis forecast a net present value of €284 mn and an EBCR of 1.40. In the original economic analysis the assumption was made that rail operators would introduce new rolling stock; this factor was important in the relative attractiveness of road and rail options. However, the cost associated with the new rolling stock was not included in the original assessments. JASPERS therefore requested that it be included, at a cost of €84 mn. The cost benefit analysis included a series of sensitivity tests for both revenue and costs variables. For all scenarios the project was forecast to return positive economic and financial indicators, justifying the project for Cohesion Policy co-financing.

The breakdown of benefits and costs associated with the scheme is presented in Figure 1.2. This shows that the highest forecast benefits were the reduction in vehicle operating cost for car users who switch to rail and time savings for passengers. JASPERS noted that this was in-line with other railway infrastructure projects. The high estimate of vehicle operating cost savings was generated by the anticipated transfer of demand from the A4, which as a motorway had high vehicle operating costs and tolls. At the time of evaluation no tolls were operating on the A4 and no confirmed timeframe of toll implementation was given; although stakeholders commented that this would be anticipated in the short to medium term. However, it is the view of the evaluators that any short term reduction in outturn vehicle operating cost benefits would not unduly influence the value for money of the E30 scheme in the longer term; the view of stakeholders supported this.

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7 The CBA Blue Book was prepared by JASPERS and was consistent with EU requirements.
The financial analysis included consideration of value of time savings for passengers changing from road to rail, newly generated passenger trips by rail and existing rail trips. Safety and environmental benefits represented a relatively small proportion of the forecast benefits. However, JASPERS confirmed in consultation the view expressed in the 2010 completion note, that the economic assessment was conservative as it did not include all potential benefits. Freight time savings and vehicle operating costs for ongoing car users (due to roads being less congested) were not included in the analysis. The value of time assumptions relating to freight needed to be considered from the perspective of the operators, rather than the costs of goods to the end user. For routes with entirely freight or a high percentage of freight, the need to identify an accurate and bespoke value of time was highlighted. However, the freight travelling on the modernised E30 section is travelling ~500 km from end-to-end, whilst the improvements on the E30 were only 130 km. The impact of not including value of time benefit calculations for freight was therefore considered by stakeholders to be limited. The exclusion of such issues can be considered a systematic bias reflective of Polish rail project ex-ante evaluations at that time, and in part a consequence of the institutional capacity/knowledge of the beneficiary.
Overall, and in the absence of quantitative outturn demand data, there was no evidence to indicate that the project would not represent value for money.

Financial sustainability

The operation and maintenance costs associated with E30 project were assumed to remain relatively constant between 2010 and the end of the reference period 2039; the respective values were €121,000/km and €126,000/km. The analysis, which considered fixed and variable costs, as well as high maintenance costs, was accepted by JASPERS; the higher than average maintenance costs was justified by the high forecast usage of the line by freight trains.

The cost benefit analysis identified that the E30 project was forecast to have a negative financial profitability, as future net revenues from train operators were insufficient to offset the initial capital costs. Because the project was a public railway and therefore revenue generating, a funding gap calculation was used to identify the public expenditure required to support the project. The funding gap was estimated at 81%, demonstrating low net financial revenues. It was noted by stakeholders that the funding gap in the revised 2015 application (for the completion of the 13 km section east of Kraków) will be slightly higher than the original application. However, this would not influence the overall value for money.

The revenues from track access charges were forecast to be higher than the operating costs for each year to 2030; the aforementioned higher access charges will further enhance the financial sustainability assuming that operating costs remain as forecast. However, it should be noted that when debt service and depreciation were included in the analysis, the costs exceeded revenues, with the deficit being met by the Polish National Rail Fund. Discussions with stakeholders identified no changes to the forecasts that would change the financial sustainability of the E30 project.
2 Poland: A1 Toruń - Stryków

2.1 Case Study Summary

The Toruń to Stryków section of the A1 motorway (Poland) was completed in April 2014, representing a key link in the strategic road corridor connecting the north of the country, and the strategically important port of Gdańsk, with central Poland and the border with the Czech Republic in the south. The project was part of the Operational Programme for Infrastructure and Environment, 2007-2013, and is located on the TEN-T network, and its selection was based on the need to complete the north-south link to serve local, national and international traffic. The first section of the A1 was completed in the area of Łódź in 1989, with the section between Gdańsk and Toruń completed in 2011. The feasibility study for the Toruń - Stryków section identified that alternative alignments were considered. No evidence was found that alternative modes or routes were considered during the feasibility study.

A number of issues have affected the implementation of the Toruń – Stryków project, which has resulted in delays to the project and tolling only being in operation for Heavy Goods Vehicles (HGV’s) at the time of evaluation in April 2015. Difficulties were experienced with the contractors originally appointed to undertake the works, leading to the cancellation of three contracts and a requirement to re-tender. The evaluation has noted that the disaggregated approach to procurement, including the letting of seven separate contracts for sections of the project, may have contributed to the delays experienced. The original two-year construction period was also considered by stakeholders to have been unrealistically short, with a four-year period being required in outturn.

Construction of the project was completed in April 2014 and tolling is in operation for HGV’s. Delays have been experienced in the implementation of tolling for general traffic, in part due to ongoing discussions over the technical solution; Manual or Automatic Toll Collection. A separation of infrastructure and tolling contracts, and associated procurement procedures, was also cited by stakeholders as contributing to project delays. The evaluation has determined that the ex-ante forecasts were generally supported by evidenced assumptions, but that the quality and robustness of such evidence varied. As noted above, the A1 feasibility study focused on alternative alignments rather than a wider re-assessment of route or modal options. Furthermore, many of the datasets used in demographic analyses were relatively old by the time of ex-ante evaluation.

Stakeholders were reticent to comment on the accuracy of the ex-ante assumptions, and many felt that it was too early post-construction to verify forecasts. No empirical evidence was made available to the evaluators before, during or after consultations to enable a comparison with forecast traffic levels. However, there was anecdotal evidence that the introduction of tolling for HGVs resulted in an initial re-routing to non-tolled alternatives, but that this trend had largely reversed 2-3 months later. A re-assessment of the project economic analysis, based on reported cost increases, determined that the project remained good value for money.

A key issue relating to the financial sustainability of the project concerned the maintenance of the infrastructure. Currently, the national road act in Poland stipulates that revenue generated from toll roads cannot be used for the maintenance of the
The majority of stakeholders acknowledged that this presents an issue for all such infrastructure generally, and the A1 Toruń – Stryków project specifically. All stakeholders acknowledged the current risk around the maintenance of road infrastructure in Poland, and the potential risk that insufficient investment presents for the safety and performance of the network.

2.2 Introduction

The Directorate General for Regional and Urban Policy of the European Commission (DG REGIO) is currently undertaking an ex-post evaluation of Cohesion Policy programmes between 2007 and 2013. As part of this work DG REGIO has commissioned a study referred to as “Work Package 5: Transport” from AECOM and KPMG. Task 3 of this evaluation involves preparing case studies for 10 major projects with the following objectives as defined in the Terms of Reference (ToR):

- To verify the correctness of assumptions underlying demand and financial analyses; and
- To understand the context in which projects are implemented.

This report represents the outputs of the pilot case study for Task 3, for the A1 Toruń – Stryków project in Poland. Table 2.1 sets out the structure of this report and indicates where the Commission’s requirements, as defined within the ToR, are addressed in relation to the A1 Toruń – Stryków project.

Table 2.1 – Report structure

<table>
<thead>
<tr>
<th>Report Section</th>
<th>ToR Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>▪ Provide an overview of the selection mechanism and the factors that led to the selection of the project.</td>
</tr>
</tbody>
</table>
| 2. Project Description and Implementation | ▪ Explore if the project is a part of larger transport strategy  
▪ Give an overview of the implementation difficulties. |
| 3. Demand Analysis             | ▪ Gather information to compare planned and actual figures and trends, in order to draw conclusions on:  
  ▪ the reliability of the assumptions, demand analyses. |
| 4. Financial Analysis          | ▪ Gather information to compare planned and actual figures and trends, in order to draw conclusions on:  
  ▪ the reliability of the assumptions and financial analyses; and  
  ▪ the financial sustainability of the investment.  
▪ Explore the impacts of financial aspects (including the financial analysis if it affected project delivery) on the implementation of the project.  
▪ Identify institutional factors that are critical to produce reliable financial analyses (including demand analyses). |

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8 Major Projects are defined as those with a total cost of over €50 million
9 Construction of A1 (Toruń – Stryków Section) - 2010PL161PR030
Ex Post evaluation: Transport

5. Lessons Learnt

- Identify systematic biases (i.e. regularly occurring similar difference between assumptions and facts) in making assumptions.
- Analyse the solutions that are put in place to ensure the financial sustainability of investments.

Table 2.2 contains a list of the key stakeholders who were interviewed regarding the A1 Toruń – Stryków project. The purpose of each interview was to explore particular issues, assumptions or changes in project context, and gain a better understanding of the project implementation and operation.

### Table 2.2 – Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Infrastructure and Development</td>
<td>The Ministry of Infrastructure and Development is the Managing Authority and is responsible for Poland’s national and regional development policy, managing and distributing European Union Structural and Cohesion Funds, eliminating spatial economic disparities, and promoting social and economic cohesion. The Ministry is responsible for Poland’s transportation infrastructure, including motorways, expressways, and national roads.</td>
</tr>
<tr>
<td>Director, Department of Design</td>
<td>Implementing body with regards to EU funds for transport under the Operational Programme for Infrastructure and Environment, 2007-2013. CUPT provides support to the beneficiary (GDDKiA) in the process of investment preparation and implementation of this project, to ensure that all EU funds have been reasonably and efficiently used by 2015, verifying the financial and project data they receive.</td>
</tr>
</tbody>
</table>
| Deputy Director                                                             | Central authority of national administration set up to manage the national roads and implementation of the state budget in Poland. GDDKiA is the central government body responsible for national roads and also performs the duties relevant to this study of:  
  - Participation in the implementation of road transport policy;  
  - Collection of data and information about the network of public roads;  
  - Supervising the preparation of road infrastructure;  
  - Cooperating with other road administrations and international organizations; |
| General Directorate for National Roads and Motorways (GDDKiA)              |                                                                                                                                                                                                                                   |

Source: Terms of Reference for contract 2014CE16BAT042
**Summary of the project**

The project entails the construction of a new toll motorway section of the A1, approximately 144 km in length, between Toruń and Stryków (Figure 2.1). The project, on which construction was completed in April 2014, forms part of the north-south axis of the A1 motorway in Poland, linking the Pomerania region in the north with the Silesia region in the south. The project will serve primarily national and international transit traffic along the main north-south corridor together with some local commuter traffic. The project originally envisaged the implementation of both manual tolls and electronic toll collection for traffic. However, at the time of evaluation tolling is only operational for HGV’s.

The project had its origins in the requirement to develop the basic structure of a motorway network, or ‘grid’, to enable greater internal connectivity and also to provide strategic links between Poland and neighbouring countries. The implementation of high quality, continuous, road corridors is critical to providing Poland with the necessary infrastructure to develop economically, and integrate more closely with the European Union.
The stakeholders who were interviewed as part of this task unanimously agreed that the primary function of the scheme, in the context of the A1 as a whole, is to provide a strategic north-south link to serve local, national and international traffic. The project is intended to improve interregional connectivity and help to increase the economic competitiveness of the Kujawsko – Pomorskie and Łódzkie voivodships by attracting investment and stimulating job growth. Several stakeholders (CUPT and the Ministry of Infrastructure and Development) acknowledged this more local role that the project plays, enabling shorter trips within the region, contributing towards increased regional cohesion. However, the GDDKiA noted that the road is generating severance for some local communities and the extent of local demand is constrained by the spacing of junctions.

The completion of the A1 motorway forms a key part of the foundation upon which the national road network can be developed further, to increase the safety, capacity and quality of roads, and focus more upon local connectivity. JASPERS and the GDDKiA both commented that the key issues still facing the project are tolling and maintenance of the infrastructure.
**Project selection**

The selection of the Toruń – Stryków project can be considered as an evolution of the original concept to implement a strategic road corridor connecting the north of the country, and the strategically important port of Gdańsk, with central Poland and the border with Czech Republic in the south – the current A1 motorway. The Toruń – Stryków project forms a necessary component for the overall completion of the A1 motorway, and its selection and development should therefore be viewed in this context.

The project forms part of the National Transport Policy\(^\text{10}\) for Poland prepared by the Ministry of Infrastructure and Development, in consultation with GDDKiA. Given the scale of the project (it is the largest road project in the portfolio) it met many of the criteria used to assess the contribution towards the aims and objectives of the National Transport Policy (such as length of route, capacity, safety and strategic connectivity) and was therefore included within the Operational Programme for Infrastructure and Environment, 2007-2013. Stakeholders cited this project as being the logical choice for investment, to help complete the A1 and contribute towards the TEN-T agenda.

### 2.3 Project context and implementation

**Introduction**

This section of the report presents an overview of the objectives of the project, the policy context within which it was delivered and the implementation difficulties experienced. It therefore addresses the following items from the ToR:

- To explore if the project is a part of larger transport strategy; and
- To give an overview of the implementation difficulties.

**Objectives**

The project has broad objectives to improve the safety and capacity of the road network between Toruń and Stryków, contributing towards a high level of service for the A1 motorway as a whole. Specific objectives for the project include\(^\text{11}\):

- Eliminating bottlenecks and improving traffic flow, safety, capacity and the quality of the TEN-T road corridor, in the context of priority axis 6.1 of the Operational Programme for Infrastructure and Environment 2007-13;
- Improving efficiency and safety levels for traffic crossing central Poland;
- Improving accessibility to local communities along the corridor;
- Reducing accident rates; and
- Reducing the negative environmental impacts of traffic by redirecting heavy goods vehicles from the local road network to the motorway.

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\(^{10}\) National Transport Policy for 2006-2020 Poland.

\(^{11}\) Source: A1 Toruń – Stryków Cohesion Fund Application (2010)
Policy context
The project forms part of the National Transport Policy for Poland, and is included within the Operational Programme for Infrastructure and Environment, 2007-2013. These documents identify the importance of completing the A1 motorway in the context of improving north-south connectivity and providing direct access to the ports of Gdańsk and Gdynia. The first section of the A1 was completed in the area of Łódź in 1989, with the section between Gdańsk and Toruń completed in 2011; this was delivered in two stages with the most northerly section completed in 2007.

The Toruń – Stryków project, and the development of the A1 as a whole, is directly aligned with the TEN-T corridor number 25 – motorway axis Gdańsk - Brno/Bratislava – Vienna. All stakeholders interviewed as part of this task referred to the project in terms of the above policy context, and noted the general recognition that the project forms part of the national transport strategy, and contributes towards the wider agenda for transport in Poland.

The project (at 144 km in length) makes up 16% of the TEN-T roads constructed and 9% of all new roads constructed during the programming period in Poland.

Project implementation
The Application Form (Section D, page 37-38) for the project identified a two year construction period (May 2010 – May 2012). However, construction was completed in April 2014 following a four-year construction period. A number of issues have affected the implementation of the Toruń – Stryków project, which has resulted in delays to the project and tolling only being in operation for HGV’s at the time of evaluation in April 2015. The following section provides a brief overview of these issues, drawing upon information gathered during the stakeholder interviews.

For the purposes of construction, the project was divided into seven construction contracts, as set out in Table 2.3. It is understood this is related to the capacity of contractors to deliver a project of this scale in its entirety. Several stakeholders considered that the approach used overly complicated the procurement and subsequent implementation of the project, which may also have contributed towards the delays incurred to delivery. It was stated by JASPERS that this approach was common in Poland at the time. It was also felt that the rigidity of not allowing any variations to the design or contract during construction meant that any potential time/cost efficiency savings which were identified could not be realised.
During the implementation of the project, difficulties were experienced with the contractors originally appointed to undertake the works for the Czerniewice to Kowal sections. Stakeholders differed in their views as to the level of responsibility which should be apportioned to the contractors, but it is understood that the main points of contention related to time taken to mobilise, project progress and compensation events. The net result of these difficulties was that three contracts were cancelled and one contractor left the project, causing a delay to the project; the contractors left the project in September 2012 and the new contract was awarded in April 2013. A new contractor was appointed, following a second tender exercise, to complete these sections of the route. The GDDKiA and Ministry of Infrastructure and Development were not able to confirm the level of cost overrun as a result of these delays.

The subject of public procurement was discussed with all stakeholders, both generally and in the context of this project. It was felt by some stakeholders (JASPERS and the CUPT) that procurement practice at the time when contracts were being let for this project focussed almost entirely on price, creating a bidding war amongst tenderers which led to reduced levels of quality in terms of the services provided and work undertaken. Conversely, the GDDKiA considered that procurement practice at this time did consider more factors than just price, and had worked successfully for a number of years previously. However, when the quantity of tenders increased, as a result of the programme of national infrastructure delivery, this placed pressure on the available resources required to sufficiently plan for and manage the tender process. This would have inevitably had an impact upon the thoroughness during the evaluation phase and overall quality assurance of the procurement process.

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12 It should be noted that on some sections, separate contracts were issued for separate workstreams e.g construction and supervision.
In the context of the A1 Toruń – Stryków project, stakeholder opinion was divided as to whether the procurement practice at the time was a contributing factor towards the subsequent performance of, and relationships with, contractors who worked on the project. Whilst all stakeholders agreed that works were procured in line with public law at the time, JASPERS felt that the tender process not rigorous enough and placed too much emphasis on obtaining the lowest price. The GDDKiA noted that new directives for public procurement are in the process of being implemented, which will place more emphasis on quality and economic and social criteria. However, it was unclear what this would mean in practice.

One stakeholder (JASPERS) suggested that the delays to project implementation were also as a result of unrealistic deadlines being set. The example given was in relation to the original project deadline of May 2012, which was intended to coincide with the start of the UEFA Euro 2012 Championship, being jointly hosted in Poland and Ukraine. The original construction schedule forecast a two year construction period, which stakeholder felt was quite ambitious.

At present, tolling is only in operation along the A1 Toruń-Stryków section for HGV’s. It is understood that discussions are currently underway at the ministerial level regarding the plans for tolling the route for general traffic. The tolling system to be used and timescales for implementation were not currently clear, although the Ministry of Infrastructure and Development indicated that Automatic Toll Collection (ATC) may be the preferred solution, and that a single solution for both HGV’s and general traffic could be an option. The GDDKiA commented that ATC offers the possibility to build in greater financial sustainability to the project. This was an isolated view and no supporting evidence was provided.

The reasons as to why tolling was not introduced for general traffic, as originally intended, were cited by stakeholders as being due to the delays in constructing the road infrastructure, the fact that the Manual Toll Collection (MTC) does not offer the most efficient solution and the difficulties around reaching an agreement with a concessionaire to operate the toll. The stakeholder consultation identified that the current contract with the operator of the tolls for HGV’s expires in 2018, and that a tender for the new contract will be issued once a decision has been made regarding the preferred technical solution, with the tendering process likely to take around one year to complete.

Several stakeholders noted the fact that in Poland the implementation of road infrastructure and tolling systems are treated as separate projects, even when they collectively form part of the same scheme, as in the case of A1 Toruń – Stryków. This can therefore lead to delays between the completion of the infrastructure and the implementation of the tolling. In the case of this project, there was a delay of several months for the HGV tolling to become operational and, as discussed above, the tolling for general traffic is still yet to be implemented.

Uncharacteristically severe weather also caused a delay to the construction schedule; however stakeholders noted that this delay was in terms of weeks, so relatively minor in comparison to the slippage to the overall project timescale. There was no evidence that the financial aspects of the project influenced its implementation.
2.4 Demand Analysis

Introduction
This section of the report presents an overview and high level judgement of the demand analysis assumptions relevant to the A1 Toruń – Stryków. It therefore addresses the following item from the ToR:

- To gather information to compare planned and actual figures and trends, in order to draw conclusions on the reliability of the assumptions for demand analyses.

Review of assumptions
Table 2.4 presents a summary of the thematic judgement of the demand analysis for the A1 Toruń–Stryków, derived from Task 2a of this evaluation. A RAG (Red:Amber:Green) classification has been used to summarise the quality of assumptions:

- Red [R]: No robust evidence to support assumptions was evident;
- Amber [A]: Some evidence to support assumptions was available but varied in quality; and
- Green [G]: robust evidence of assumptions was presented.

Table 2.4 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The population within the immediate proximity of the new road has been considered in the application form and the Feasibility Study, with population, employment and residence information used to inform traffic generation estimates in the model. The history of population increase/decrease has been explored to forecast to the future growth.</td>
<td>A Some evidence of use of basic demographic data sets; however in some instances these are old or not applied at a suitable geographic scale. Stakeholders confirmed that demographic data is provided from government ministries.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The feasibility study considered three alignments of the motorway, with no reference to alternative modes or routes. This reflected the location and function of the A1 as part of a TEN-T corridor. The national VISUM traffic forecasting model has been applied.</td>
<td>A Some evidence that the approach taken to demand analysis allows forecasting of the project impact on other transport corridors (i.e. model scope includes sufficiently wide area) or transport modes (i.e. model includes a mode choice element).</td>
</tr>
</tbody>
</table>

Consumer Behaviour Summary | Scoring
Demand analysis undertaken using the VISUM traffic forecasting model for Poland, using nationally collected data from 1995, 2000 and 2005.

The methodology applied included the project's impact on consumer behaviour.

**Affordability/Tariffing Summary**

A new toll system will be put in place across the Polish toll road network. Different toll rates will apply to different types of user to reduce environmental damage, congestion etc. The precise level of tolls and affordability of these are not presented.

**Scoring**

Some consideration of an appropriate tariffing arrangement, possibly making use of existing tariffing arrangements. Schemes where tariffing is not applicable have also been scored amber.


**Verification of assumptions**

When asked to provide data on actual traffic figures for the project several stakeholders considered that it was too early to consider this information as, in their opinion, the scheme is not yet complete; the tolling of the route for general traffic was cited as being required before the project could be considered complete. No firm opinions were expressed from stakeholders regarding the likely results or impacts of the scheme, particularly in terms of traffic flows along the A1, as they considered that the results of the 2015 traffic surveys should be awaited.

The six stakeholder interviews conducted in April 2015 provided stakeholders with the opportunity to identify and discuss the assumptions and wider observations, from the project which they felt would be of interest to the Commission.

It was felt intended cohesion benefits of the Toruń – Stryków scheme may not be fully realised due to the competing aims of the strategic north-south function of the route, with the need to provide connectivity for local people living in the vicinity of the scheme. For example, GDDKiA stated that the spacing of junctions on the road had constrained the connectivity for local people, and created severance between some communities. No data was provided to validate whether traffic on the road was higher or lower than forecast as a result of this.

Generally, it was felt that it is too soon to consider the results of cohesion policy in relation to the A1 Toruń – Stryków project, as more time is required for any observed changes to become significant.

It is understood from stakeholders that an ex-post impact evaluation report for the A1 Toruń – Stryków project will be prepared by CUPT in early 2016, following the financial closure of the project. This data will include the results of the national traffic survey for the entire Polish road network, which is undertaken by GDDKiA every five years. The traffic data will be compared with that from the previous survey undertaken in 2010 and GDDKiA considered that the results are likely to be very interesting given the amount of infrastructure which has been implemented in the intervening period.
The GDDKiA commented that the results of the 2015 national traffic surveys will also be very interesting in the context of understanding the effect of tolling on HGV traffic. Anecdotally, it was explained that around 50% of HGV traffic re-routed from the Toruń – Stryków section of the A1 in the first two months of tolling becoming operational, but that the vast majority of the observed traffic returned in the months following this. It was suggested that the poor quality of the local roads and unreliable journey times meant that the A1 remained the more attractive route for HGV traffic. It was also explained that the different toll fares for Euro I-V rated vehicles, led a large number of operators to upgrade their fleets to take advantage of lower costs associated with the more efficient vehicles.

In terms of other data sources which will be used to inform an assessment of the project post financial closure, the GDDKiA and CUPT confirmed that these will include accident data from the police, population/demographic data from the national government and economic data (such as GDP) from the Ministry of Finance. No data relating to the outturn position of the project was provided by stakeholders prior to, during or after the interviews.

2.5 Financial analysis

Introduction
This section of the report presents an assessment of the financial analysis and addresses the following elements from the ToR:

- To gather information to compare planned and actual figures and trends, in order to draw conclusions on:
  - the reliability of the assumptions and financial analyses, and
  - the financial sustainability of the investment
- To explore the impacts of financial aspects (including the financial analysis if it affected project delivery) on the implementation of the project;
- To identify institutional factors that are critical to produce reliable financial analyses (including demand analyses);
- To identify systematic biases (i.e. regularly occurring similar difference between assumptions and facts) in making assumptions (where the financial analysis contained methodological errors, the contractor will recalculate the financial analysis); and
- To analyse the solutions that are put in place to ensure the financial sustainability of investments.

Overview of financial analysis
The project was estimated to cost €1.965 bn\textsuperscript{13} in 2010. This was subsequently revised to €1.298 bn\textsuperscript{14} in 2012 and finally €1.370 bn\textsuperscript{15} in 2014. These estimates are shown in Table 2.5 along with the level of contribution from EU funds.

\textsuperscript{13} Source: A1 Toruń – Stryków Project Application – October 2010
Table 2.5 – Cost of and contribution to A1 Toruń–Stryków

<table>
<thead>
<tr>
<th>Application</th>
<th>Cost €bn</th>
<th>Contribution €bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application – October 2010</td>
<td>1.965</td>
<td>1.254</td>
</tr>
<tr>
<td>Revision – October 2012</td>
<td>1.298</td>
<td>0.456</td>
</tr>
<tr>
<td>Revision – April 2014</td>
<td>1.370</td>
<td>0.751</td>
</tr>
</tbody>
</table>

The reduction in cost from the original application to the subsequent revisions is primarily due to the results of procurement process. The prices associated with contracts entered into were, in many cases, significantly lower than estimated.

Task 2b of this evaluation reviewed the quality of the financial analysis for the A1 Toruń–Stryków project. The quality of sensitivity analysis is considered by the evaluators to be poor as it only refers to Construction Costs and Internal Rate of Return (IRR) with a very low variance of the assumptions (±1%). Normally this sensitivity should be performed in a range of ±5% up to ±20%. The review highlighted a number of risks which may affect the financial performance of the project, most notably:

- Tolls are currently collected for HGV’s, but not general traffic, therefore reducing the amount of revenue generated by the project;
- Revenue generated by tolls cannot be used for maintenance of the infrastructure, leading to a potential shortfall in funding for maintenance, although there is no evidence to suggest that the maintenance costs of the scheme will not be met by Polish state funds; and
- There is a revenue risk regarding the forecast traffic using the route - volume variation is not considered as a sensitivity value and no considerations are included in the CBA to highlight this.

A number of these risks directly impact upon the financial sustainability of the investment which is discussed in more detailed below. As noted in Section 2.4, no outturn demand data has been available. The evaluation has therefore considered the impact of the increased implementation costs on value for money, and the assumptions underlying the defined benefits. The breakdown of benefits associated with the scheme is shown in Figure 2.2. This shows that the vast majority (nearly 90%) of benefits of the scheme are travel time savings, through the enhanced connectivity compared with the existing national road 1. The level of time savings realised will be directly linked to the level of demand (traffic) using the A1. The other savings identified will in part be linked to the level of demand, but also to the types of vehicles being used; it was anecdotally noted in Section 2.3 that freight operators were upgrading fleets to reduce toll charges, resulting in lower environmental emissions.

14 Source: A1 Toruń – Stryków Project Application – October 2012
15 Source: A1 Toruń – Stryków Project Application – April 2014
The prominence of time saving benefits required an assessment of the value of time used and, in particular, the growth rate that was applied. The Application Form for the project noted that the values of time for passenger and freight vehicles were derived from previous studies into home-work, business, tourism and other trip purposes. No sources of this evidence were reported. The growth in value of time was directly related to the growth in GDP (page 27 of the Application Form).

In overall economic terms, the Application Form (Page 52) forecast an Economic Benefit to Cost Ratio (EBCR) of 6.29. In the absence of outturn traffic data, the evaluators have re-assessed the EBCR in terms of the change in project costs i.e. assuming demand remained as forecast what impact would the increased cost have on the economic return. Applying the 57% increase in project costs defined above, the EBCR would reduce from 6.29 to 3.8, which remains good value for money.

However, two additional Cost Benefit Analyses were prepared for the A1; first in January 2012; and secondly in November 2013. These generated EBCR values of 3.54 and 2.84 respectively. It is not clear from the project documentation why these values varied and the different factors that applied. It is possible to determine that the total benefits in the three source documents varied, as shown in Table 2.6. A sensitivity test of applying the latest (and highest) estimated outturn cost (€3.332m) to the lowest reported benefits of €6,051m (from the 2013 CBA) would generate a EBCR of 1.82\(^{17}\). This indicated that despite the increase in costs, the A1 still represents good value for money if the forecast traffic demand is realised.

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\(^{16}\) Source: 2010 Application Form Economic Appraisal

\(^{17}\) This again assumes that traffic demand was as per forecast.
Ex Post evaluation: Transport

Table 2.6 – Benefits of A1 Toruń–Stryków

<table>
<thead>
<tr>
<th>Source</th>
<th>Total Benefits (£bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Form (2010)</td>
<td>9.23</td>
</tr>
<tr>
<td>CBA Report (2012)</td>
<td>7.90</td>
</tr>
<tr>
<td>CBA Report (2013)</td>
<td>6.05</td>
</tr>
</tbody>
</table>

**Financial sustainability**

Another topic of discussion with stakeholders in the context of financial sustainability of the project related to maintenance. Currently, the national road act in Poland stipulates that revenue generated from toll roads cannot be used for the maintenance of the infrastructure. The majority of stakeholders acknowledged that there is no link between tolls and maintenance in Poland and that this presents an issue for all such infrastructure generally, and the A1 Toruń – Stryków project specifically.

Maintenance costs are included in the CBA for the project and these are based on standard assumptions supplied by GDDKiA. Given the length of the forecast period (25 years), no assurance is provided as to the suitability of this data, which may present an issue for the financial sustainability of the project into the future.

At present, it is the responsibility of the beneficiary to demonstrate commitment to the maintenance of infrastructure co-financed by EU funds. However, it is understood that the beneficiary for the A1 Toruń – Stryków project, GDDKiA, cannot commit expenditure to maintenance as funds for this are held within the state budget, and not the national road fund, from where GDDKiA draws its funding. In this scenario, GDDKiA are dependent on the Ministry of Infrastructure and Development to secure the necessary funding, as part of their annual budget allocation, to maintain the road network.

All stakeholders acknowledged the current risk around the maintenance of road infrastructure in Poland, and the potential risk that insufficient investment presents for the safety and performance of the network. This risk was, however, very much considered to be one for the future, and secondary to the immediate need to secure funding for, and implement, infrastructure required for Poland’s national development.

In terms of solutions being put in place to ensure the financial sustainability of future investments, GDDKiA explained that a new maintenance model is currently being developed and that this will apply to the whole Polish road network, including this project, and would be implemented by the maintenance department of GDDKiA. It was stated that this model, on average, will lead to a forecast 20% reduction in current maintenance costs for a scheme. No further information regarding the details of this maintenance model was, however, provided at or subsequent to the interview.
2.6 Lessons Learnt

In the context of this pilot case study, the opportunity to discuss the project face-to-face with a range of stakeholders provided greater depth to our understanding of the project, therefore adding value to the evaluation as a whole. The pilot case study also generated a number of lessons which will be taken on board to help improve the methodology for evaluating the remaining eight case study major projects. The key lessons learnt from this pilot can be summarised as follows:

- The period of dialogue and engagement with identified stakeholders prior to the face-to-face interviews should be extended to ensure that the relevant individuals/organisations fully understand the purpose and objectives of the evaluation. There was some reluctance to engage fully in the evaluation and provide detailed opinions on details of the project. A longer lead-in period will help to establish a relationship with those being interviewed, yielding greater openness during the face-to-face meetings.

- The unavailability of ex-post traffic data has limited the ability to re-assess the economic analysis of the project. Details on the assumptions underlying the original analysis were also largely not available. A review of data availability should be undertaken for subsequent case studies at an earlier stage.

- Stakeholders should be encouraged, in advance of the meeting, to review and respond to the list of technical information which has been reviewed by the evaluation team in relation to the scheme in question. This was intended to provide an opportunity to confirm that the evaluation team has all of the pertinent information, and/or request any additional material which the stakeholder may hold, or be aware of. A request was made prior to the interviews for any relevant information but this did not yield further evidence from stakeholders. Further pre-interview liaison is therefore required to encourage a response. This should be led by the evaluation team’s Member State representatives. Given the reluctance of interviewees to comment on the detailed demand and financial assumptions included in the project ex-ante evaluation any background information is important to verify the assumptions.

- The list of potential stakeholders generated at the outset of the process should be tailored to reflect the fact that many organisations are not in a position to comment upon the financial aspects of the scheme – a core area for the evaluation. Where possible, contact should also be made with academics or other experts with an interest in this field who may be able to offer alternative perspectives on the project.

- All requests for interviews and information should be issued by the evaluation team’s Member State representatives. This proved effective in Poland in securing meetings with a range of stakeholders, and overcome any hesitance due to language barriers.
• A pre-meeting was held between the AECOM and KPMG technical team representatives, and the Polish Member State representative, prior to the first stakeholder interview. This was not a stated activity in the study Inception Report but was considered necessary given the complexity of the topic areas. This meeting proved very effective at confirming the scope and approach to interviews, roles and responsibilities and to ensure that the non-Polish team members understand the roles and responsibilities of each stakeholder.
3 Romania: Motorway Construction on TEN-T 7, Cernavodă - Constanța Section

3.1 Case study summary

The project consisted of the construction of a 51 km long section of the TEN-T route 7 between the cities of Cernavoda and Constanta, to the standard of a 2-lane motorway. It was completed and opened to traffic in November 2012.

The motorway connects with the existing Fetesti to Cernavoda motorway and then travels in a south–east direction to connect with the Constanta bypass. The project completed the A2 motorway link between Bucharest and Constanta. The A2 motorway forms part of the Rhine – Danube corridor, connecting the central regions around Strasbourg and Frankfurt via Southern Germany to Vienna, Bratislava, Budapest and the Black Sea.

The project was developed prior to the 2007-2013 programming period as one of the projects seeking European Investment Bank (EIB) funding in the lead-up to Romania’s accession to the EU in 2007. Financing for project implementation was originally established under Financing Contract 23 370/2005 signed by the Romanian Government, the EIB and CNADNR. Once Romania had established its operational programme for 2007-2013, additional funding was sought for the project through the Cohesion Fund. This was done in two stages: initially for funding against the Romanian Government’s funding allocation; and later against the total investment cost. The project was prioritised because of its location on the TEN-T network and its national importance as part of the road link between Bucharest and the port city of Constanta.

A comparison of the real GDP growth forecasts applied in the demand analysis against outturn values and forecasts from Eurostat indicates that the assumptions made were above the achieved GDP and Eurostat forecasts. Outturn traffic data for the project have not been collected to-date (as some elements of construction, such as service areas, have not been completed) so it has not been possible to draw any conclusions on the assumptions concerning forecast travel demand. Accident data for the parallel national road (the DN22) have been obtained for 2007–2012. Early indications are that overall casualty numbers on this route have reduced substantially as traffic has diverted to the new motorway link.

The financial analysis predicted an EBCR of 1.39 and a subsequent JASPERS review of the economic and financial appraisal produced an increased value of 1.8. An outturn cost will not be available until all elements of the construction have been finalised, but the JASPERS review indicated that reasonable changes to key project variables did not present a risk to the project objectives.

Since the funding decision for the Cernavoda to Constanta motorway was made in the 2007-2013 programming period, Romania has developed a national General Transport Masterplan. This had the objectives of establishing national transport scheme appraisal guidance and developing a national multi-modal model capable of developing a transport strategy and undertaking project prioritisation to develop future priorities.

for investment. Although previous appraisal tools were available, the development and appraisal of schemes in the 2014-2020 programming period will be both more robust and more comprehensive as a result of the investment in this national masterplan.

### 3.2 Introduction

**Introduction**

Table 3.1 contains a list of the key stakeholders who were interviewed regarding the construction of the Cernavoda – Constanta motorway section\(^\text{19}\). The purpose of each interview was to explore particular issues, assumptions or changes in project context, and gain a better understanding of the project implementation and operation.

**Table 3.1 Stakeholders interviewed**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Transport and Infrastructure, Head of Strategy Directorate</td>
<td>The Romanian Ministry of Transport is the agency of government which establishes transport strategy and national policy. It acts as the State Authority for transport and infrastructure.</td>
</tr>
<tr>
<td>Managing Authority for SOP-T, under Ministry of Transport</td>
<td>The sectoral operational programme &quot;Transport&quot; (SOP-T) 2007-2013 is the strategic instrument which establishes the priorities, objectives and financial allocation for the development of the transport sector in Romania with community aid. The Managing Authority is responsible for projects funded under SOP-T in the 2007-2013 programming period and will take the same role for projects funded in the 2014-2020 programming period.</td>
</tr>
<tr>
<td>CNADNR – National Company in charge of Roads Administration</td>
<td>The National Company of Motorways and National Roads in Romania is the entity responsible for the administration of strategic roads in Romania, operating under the Romanian Ministry of Transport. CNADNR is the final beneficiary of the A2 Cernavoda – Constanta motorway section.</td>
</tr>
<tr>
<td>JASPERS (Joint Assistance to Support Projects in European Regions)</td>
<td>JASPERS provided a review of the project under preparation within the framework of a Finance Contract between Romania and EIB and CNADNR, signed in December 2005 in order to determine the timeliness of Cohesion Fund support to the implementation. In addition to the support on this project, JASPERS provide a range of support to the Romanian authorities and therefore have knowledge of the wider policy context of the project.</td>
</tr>
</tbody>
</table>

**Summary of the project**

The project is located in the South-East development region of Romania within the borders of Constanta County. The project consists of 51 km of new two-lane motorway constructed between the cities of Cernavoda and Constanta (Figure 3.1 and 3.2). The motorway connects with the existing Fetesti to Cernavoda motorway links, and then travels in a South – Eastern direction to connect with the Constanta bypass. The project has been a stand-a-lone project and completes the A2 motorway between

\(^{19}\) Cernavoda – Constanta motorway, 2008RO161PR002, sectoral operational programme "Transport, 2007RO161PO003.
Bucharest and Constanta, which forms part of the TEN-T priority axis number 7. The project was delivered with a financial contribution from the Cohesion Fund.

**Figure 3.1 TEN-T 7 Cernavoda – Constanta A2 Motorway**

The project was developed to meet the technical standards set out in Romanian national guidance note no. 162/2004 and the Trans-European North-South Motorway (TEM) standards for a road with a design speed of 140 km/h. The constructed highway consists of a two-lane motorway with 3.75 m lanes, 3 m emergency lanes and 0.5 m shoulders. The central reserve is 4 m across. There are 21 structures (bridges and overpasses), one junction, two rest and service areas and a single maintenance area over the length of the scheme.

**Figure 3.2 A2 Constanta – Cernavoda TEN-T Motorway**

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20 Source: TEN-T 7 Cernavoda - Constanta Cohesion Fund Application (September 2014)
The project was technically independent; however, it was developed alongside the Constanta bypass scheme at the feasibility stage. The A2 motorway section between Cernavoda and Constanta was opened to traffic in November 2012. The Constanta bypass is a 22 km section of road designated the A4 motorway and was opened in phases between July 2011 and July 2013. It bypasses the port city of Constanta and links in to the town of Ovidiu to the north. There are plans to extend the motorway network from here to the Bulgarian border to the south.

**Project selection**

Romania did not have a national transport strategy in place at the time of the selection of projects for the 2007-2013 Cohesion Policy programming period. In the years preceding, Romania had been preparing for EU accession (2007) by developing projects to meet the requirements of EC Directive 96/53\(^{21}\) (Council Directive 96/53/EC of 25 July 1996 laying down for certain road vehicles circulating within the Community the maximum authorized dimensions in national and international traffic and the maximum authorized weights in international traffic). In some cases it was necessary to build new sections of motorway to meet the Directive’s requirements. However, in most cases rehabilitation of existing roads was sufficient. Prior to accession, funding support for projects included a European loan (for example from the European Investment Bank) or an application through the Instrument for Structural Policies for Pre-Accession (ISPA).

When Romania started developing projects for their 2007-2013 operational programme, the priorities were still clearly defined by the need to meet EC Directive 96/53, and also to complete projects aligned with the TEN-T priority axes in Romania. For this reason, project selection was in many ways straightforward: for the highway networks, projects were prioritised because of their location on the TEN-T. Some technical selection parameters were considered in the prioritisation process, but essentially the list of projects was evident and this was generally accepted by all parties.

In the case of the Cernavoda to Constanta motorway, the project lies on the TEN-T and was considered to be of national importance as it forms part of the highway link between the capital city of Bucharest and the port city of Constanta. The port at Constanta is one of the largest in Europe (and the largest on the Black Sea). It is also an important tourist destination and its location on the core transport network makes it a gateway to other Black Sea resorts.

### 3.3 Project context and implementation

**Objectives**

The socio-economic objectives for the project are set out in the 2008 Application Form and the principal objectives relate to the improvement of travel conditions for goods and passengers both within the study area and on the wider transport network. The objectives were to:

\(^{21}\) OJ L 235 , 17/09/1996 P.0059 - 0075
Ensure, by 2013, the construction of 51 km of modern road connection between the cities of Cernavoda and Constanta which would accommodate the forecast road user demand;

Reduce by 2013 the average travelling time between Alexandria and Craiova from 150 minutes to 111 minutes;

Reduce by 2013 the number of road fatalities and serious accidents along the route by 30%; and

Reduce by 2013 the impact of road transport on the environment and quality of life of the approximately 104,000 inhabitants living close to the congested DN2A and DN3 roads.

Policy context
The project is located on priority axis 7 of the TEN-T network which is a motorway axis linking Budapest with south Eastern Europe. The project completes the motorway link under this priority axis between Bucharest and Constanta, which is a TEN-T port and one of the main European gateways with the Black Sea.

The Cernavoda to Constanta motorway section was delivered under Romanian operational programme Transport, Priority Axis 1: Modernisation and development of TEN-T priority axes aiming at sustainable transport system integrated with EU transport networks. This priority axis aims to enhance the cohesion between Romania and other EU Member States by significantly reducing travel times, with improved safety and quality of service to principal destinations, domestically as well as Europe-wide, for both passengers and freight, along the TEN-T priority axes 7, 18 and 22.

The importance of a strategic road link between Bucharest and Constanta has been understood for a long time and construction of a motorway standard road began in the communist era, but was stopped in the 1990s. Other sections of the route were developed as Romania worked towards EU accession, with new sections opening from 2004 onwards. The Cernavoda to Constanta section was initially developed as a project with funding from the EIB. Completion of this motorway link was identified as both a national and European priority bringing a section of the core TEN-T network up to motorway standard.

Project implementation
The Cernavoda to Constanta section was completed and fully open to traffic in November 2012. The opening was phased by section as set out in Table 3.2.

Table 3.2 Opening of Cernavoda – Constanta Motorway

<table>
<thead>
<tr>
<th>Date</th>
<th>Road Section and Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 July 2011</td>
<td>Murfatlar to Constanta – two of four lanes</td>
</tr>
<tr>
<td>30 September 2011</td>
<td>Murfatlar to Constanta – all four lanes</td>
</tr>
<tr>
<td>19 July 2012</td>
<td>Cernavoda to Medgidia – two of four lanes</td>
</tr>
<tr>
<td>19 July 2012</td>
<td>Medgidia to Murfatlar – all four lanes</td>
</tr>
</tbody>
</table>
The 2014 Cohesion Fund application identified the project cost to be €434 mn, with €305.7 mn being provided from the Cohesion Fund.

The project was originally developed during Romania’s pre-accession period as it was identified as being of strategic importance and as fulfilling Romania’s pre-accession terms in relation to transport. Funding was sought from the EIB and the initial development of the project was therefore made according to the requirements of the EIB. Once Romania had established its operational programme for 2007-2013, the project sought additional funding through the Cohesion Fund. This was done in two stages. Initially funding was sought for the Romanian Government’s funding contribution to the total investment cost. Later in the project development, a further application was made to extend Cohesion Fund support to the eligible portion of the total investment cost (i.e. including the portion previously supported by the EIB loan). This approach released the EIB funding for use on other projects (a condition of this application was that the outstanding EIB loan would only be used to support other transport infrastructure projects in Romania).

The project was contracted in two sections covering Cernavoda to Medgidia and Medgidia to Constanta, with different contractors awarded each section.

The approach to contractor procurement applied for the Cernavoda to Constanta project was a single stage tender (i.e. there was no pre-qualification exercise) with contract award decided by the lowest price tender received.

This approach has been adopted to prevent problems with disputes at the contract award stage, which had occurred with previous projects relying on a combination of technical capability and price as award criteria. Results of such tenders were often contested, because unsuccessful contractors suspected that their competitors had exaggerated their technical capacity to undertake the work.


The contract applied to each of the Cernavoda to Constanta lots was a yellow FIDIC contract (see footnote 7 on page 17). The Managing Authority for SOP-T considered that one of the benefits of the yellow contract type is that they pass a substantial part of the project risk to the contractor.

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23 OJ L 134 , 30/04/2004 P. 0114 – 0240
Two issues materially affected the construction programme: expropriation of land required for the project; and the discovery of an archaeological site. Problems with expropriation have affected a number of schemes as the process in place on land acquisition during the 2007-2013 programming period took a long time to work through and resulted in many contracts being signed before expropriation permits have been received. A new process has now been established which has accelerated expropriation and so this problem should not affect future projects. A significant archaeological finding during construction lead to delays and required additional work.

In 2011, CNADNR took the decision to terminate the contract for the Cernavoda to Medgidia section of the project because of delays and problems associated with obtaining construction permits and a failure to complete archaeological-related works.

The contract was re-tendered and the contract awarded to the contractor for the Medgidia to Constanta section in September 2011. Construction was originally scheduled to take two years, commencing in 2009, but in the end the project was opened in November 2012. The issues during construction and change of contractor therefore account for a delay of approximately one year.

3.4 Demand analysis

Review of assumptions

The economic and financial appraisals of the Cernavoda to Constanta motorway were heavily dependent on the forecast travel demand and the consequent time savings. A high level summary of the demand analysis carried out for this project is shown in Table 3.3.
Table 3.3 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Feasibility Study considers population totals and population density in an area directly influenced by the scheme as well as wider areas indirectly affected. Additionally, the economic potential has been considered, looking at employment areas, tourism and GDP. The evolution of the population of Constanța County during the period 1990-2002 is also presented; however, no evidence is presented to indicate that this information was used in the development of travel demand forecasts.</td>
<td>A</td>
</tr>
<tr>
<td>Demographic information has been discussed during feasibility work; but much of the information could now be considered out-of-date.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Feasibility Study included a brief review of transport infrastructure by mode in the corridor, but detailed analysis is confined to highway alternatives. TRANSCAD model applied with no consideration of impact of other modes.</td>
<td>A</td>
</tr>
<tr>
<td>Project selection is on the basis that it is situated on the TEN-T network.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer Behaviour Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRANSCAD model produced by Louis Berger consortium with simple forecasts made by applying Romanian national forecasts for national roads.</td>
<td>A</td>
</tr>
<tr>
<td>The methodology applied is adequate but does not consider the impact of variable demand.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability/Tariffing Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>No tolling element to this scheme, hence no consideration of tariffing or affordability issues.</td>
<td>A</td>
</tr>
<tr>
<td>N/A. Schemes where tariffing is not applicable have been scored amber.</td>
<td></td>
</tr>
</tbody>
</table>


The following are the key assumptions used in the generation of the demand analysis and subsequent cost benefit analysis:

- Real GDP growth rates: These have been presented in the Traffic Report for the medium term as a range of between 3.5% and 6%. These were national GDP rates, and the use of such data is an example of a systematic bias;

- Demand Assumptions: 2005 and 2010 traffic flows on the DN22 (which was the primary route between Cernavoda and Constanța prior to the opening of the motorway) and the A2 motorway (Table 3.4). These flows are provided for the ‘without project’ scenario and ‘with project’ scenario. All traffic flows provided are two-way annual average daily traffic flows;
Table 3.4 2005 and 2010 forecast demand flows (AADT)

<table>
<thead>
<tr>
<th>Year</th>
<th>Road Section</th>
<th>Without Project</th>
<th>With Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>Constanta – Cernavoda Motorway</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Existing DN22</td>
<td>18 500</td>
<td>-</td>
</tr>
<tr>
<td>2010</td>
<td>Constanta – Cernavoda Motorway</td>
<td>-</td>
<td>25 300</td>
</tr>
<tr>
<td></td>
<td>Existing DN22</td>
<td>24 000</td>
<td>300</td>
</tr>
</tbody>
</table>

- Journey time assumptions: Reduction in average travel time for road journeys from Bucharest to Constanta from 150 minutes to 111 minutes after project completion; and
- Reduction in road accident assumptions: A reduction in the number of fatal and serious accidents of 30% on the Cernavoda to Constanta corridor (consisting of the DN22 and the new motorway) as a result of the implementation of the project.

**Verification of assumptions**

No outturn traffic demand data are available for the completed motorway and it is therefore not possible to draw any conclusions on the assumptions concerning forecast travel demand. No rationale was provided by stakeholders as to why outturn data was not collected/available in 2015. It is expected that data will be compiled once the project handover is completed (following the completion of service areas and other outstanding elements of the project).

A comparison of the national real GDP growth assumptions applied in the modelling and appraisal against Eurostat published data and forecasts for Romania indicates that the projected assumptions are higher than the real GDP growth recorded and forecast by Eurostat. Figure 3.3 indicates that initial change in real GDP was higher than predicted by the Traffic Report to some extent offsets the impact of the global economic downturn on Romanian GDP and that current Eurostat forecasts of a 3.3% increase in real GDP per annum maps closely with the lower end of the range covered by the data provided in the Traffic Report at a 3.5% increase in real GDP per annum.

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24 Eurostat table of Gross Domestic Product and main components at market prices. Last updated 13.04.2015
Outturn accident data are not available for the completed motorway; however, data for the parallel DN22 route (which was the principal road route between Cernavoda – Constanta prior to the construction of the motorway) have been obtained for 2007-2012 (see Table 3.5).

Table 3.5 2007–2012 accident data for the DN22

<table>
<thead>
<tr>
<th>Year</th>
<th>Fatalities</th>
<th>Severe Injuries</th>
<th>Slight Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>13</td>
<td>23</td>
<td>73</td>
</tr>
<tr>
<td>2008</td>
<td>10</td>
<td>14</td>
<td>63</td>
</tr>
<tr>
<td>2009</td>
<td>9</td>
<td>10</td>
<td>72</td>
</tr>
<tr>
<td>2010</td>
<td>9</td>
<td>19</td>
<td>94</td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>8</td>
<td>66</td>
</tr>
<tr>
<td>2012</td>
<td>5</td>
<td>5</td>
<td>48</td>
</tr>
<tr>
<td><strong>Annual Average</strong></td>
<td><strong>8.3</strong></td>
<td><strong>13.2</strong></td>
<td><strong>69.3</strong></td>
</tr>
</tbody>
</table>

Traffic started to be diverted from the DN22 to completed parts of the A2 motorway in 2012, which is considered the likely explanation for the drop in casualty numbers on the DN22 in this year.

Trend analysis is generally required to understand road safety impacts (to remove the influence of expected variance within any given year), and full conclusions on the impact of the scheme on accidents should ideally be based upon a comparison of a five-year period before the completion of the motorway with a five-year period after.
3.5 Financial analysis

Overview of financial analysis

The financial analysis of the construction of the Cernavoda to Constanta motorway includes three key elements: the capital cost; residual value; and operating costs. There are no revenues associated with the project as no tolling is proposed on the new road.

The exact final capital cost of the project is not yet known by stakeholders. Table 3.6 illustrates the development of the total investment cost from the feasibility stage onwards, including detail of European funding sought at each stage (EIB and/or Cohesion Fund). In addition, the costs have been adjusted to 2013 prices to provide a basis for comparison.

Table 3.6 – Cost of Cernavoda – Constanta motorway construction - € mn

<table>
<thead>
<tr>
<th></th>
<th>Eligible cost</th>
<th>Community Contribution (co-financing rate)</th>
<th>Romanian State Funding</th>
<th>EIB Funding</th>
<th>Total Investment Cost</th>
<th>2013 Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 Feasibility Study and CBA Report (assumed 2005 prices)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>397</td>
<td>606</td>
</tr>
<tr>
<td>March 2009 Project Application</td>
<td>83</td>
<td>71 (85%)</td>
<td>93</td>
<td>250</td>
<td>414</td>
<td>496</td>
</tr>
<tr>
<td>Project Application 2014</td>
<td>360</td>
<td>306 (85%)</td>
<td>128</td>
<td>0</td>
<td>434</td>
<td>428</td>
</tr>
</tbody>
</table>

It is possible to track the change in the approach to project financing over the period from 2005 to 2014. In 2009, the project was set to be funded by an EIB loan of €250 mn with the remainder of funds provided by the Romanian Government. The 2009 project application consisted of an application for Cohesion Policy funding against the eligible portion of the Romanian Government contribution (€83 mn) with the EIB loan remaining as a source of project funding. A later project application in 2014 sought funding against the eligible portion of the total investment cost (€360 mn) removing the requirement for EIB funding.

Allowing for inflation, the investment cost reduced by 29% between the 2005 Feasibility Study and the final project application in 2014. The Cohesion Fund was expected to contribute €305.7 mn to the cost of the project. The actual final contribution has yet to be determined. Estimates of contributions to-date are shown in Table 3.6.
Economic analysis

A cost benefit analysis (CBA) was undertaken as part of the project’s Feasibility Study in 2005, to meet the requirements of the EIB. The analysis predicted a net present value of €130.26 mn and an EBCR of 1.39.

In 2008, the Ministry of Transport and CNADNR asked JASPERS to test both the economic and financial analyses in the light of up-to-date values of costs and benefits. This work consisted of a simplified CBA using updated values to test whether the conclusions of the Feasibility Study remained sound. The update predicted a net present value of €363.2 mn and an EBCR of 1.8, the increased values confirming the predicted economic value of the study.

The breakdown of costs and benefits associated with the scheme (according to the JASPERS update to the CBA) is shown in Figure 3.4. This shows that 85% of the benefits of the scheme are predicted to be travel time savings for users, whilst the investments costs are estimated to be 85% of the total project costs.

Figure 3.4 Breakdown of forecast economic benefits

The composition of forecast benefits is in line with expectations for this type of highway project, with travel time savings comprising the majority of benefits. An observation from the case study discussions with CNADNR was that in general a conservative approach to demand forecasting was taken when developing Romanian

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25 Source: 2008 Cost Benefit Appraisal
transport projects. Despite this systematic bias the view of CNADNR was that the calculated benefits from travel time savings are robust. This was also the view of JASPERS and even if the outturn traffic levels do not reach the forecasts, the sensitivity testing and risk analysis of the cost benefit analysis indicated that there was no substantial risk to the fulfilment of the project objectives arising from reasonable changes to the key project variables.

The calculation of operation and maintenance costs for highway projects is undertaken in accordance with a regulatory framework which means that estimates are consistent across projects. However, the Ministry of Transport and JASPERS noted that the standards in this framework were developed a long time ago and should be updated in order to include new techniques and materials which can be applied in highway maintenance. There was no evidence to indicate that the use of the aforementioned framework resulted in the inaccurate calculation of operation and maintenance costs, although it could be assumed that the application of newer materials and techniques would contribute to reducing such costs. The evaluators also noted that the level of knowledge and technical expertise within stakeholder organisations had increased during the 2007-13 programming period; however, the relative inexperience (an institutional factor) at the time of the project preparation is likely to have contributed to the conservative approach to project analysis.

A number of systematic problems were identified during the case study interviews which could directly impact on the financial analysis of major projects in Romania. These problems were generally recognised by all parties and can be considered lessons learned for the development of future projects:

- The consideration of geotechnical issues and site investigation has generally been insufficient when preparing project feasibility studies. This is often due to political pressure and compressed timescales but it means that the risk of cost escalation due to unforeseen ground conditions is higher than necessary. The Ministry of Transport recognised that longer periods of time needed to be allowed to develop projects and to ensure that the feasibility process was robust enough to proceed to detailed design. The implementation of the General Transport Masterplan was assisting as it provides stability in terms of project selection and also permits the resources of the Ministry and CNADNR to be applied more efficiently to managing project development;

- The procurement process applied to-date, with its reliance on minimum cost, increases the risk of changing costs during construction. Contractors bid at low prices in order to secure contracts but are then more likely to look to find additional fees. This does not necessarily imply that the project will cost more as the contracted cost may well start at a level substantially below the feasibility estimate, but it does increase the uncertainty of the investment cost during the construction phase;

- Coupled with the above, the minimum cost approach to procurement has allowed contractors with insufficient resources and financial standing to commence work on projects. Stakeholder noted that in a large number of
cases a contractor has been unable to complete work on a project and a re-tendering process was then required. This has both programme and cost implications for projects. Improvements in the success of procurement activities are expected as the EC Directive 2014/24 on procurement start to be applied in Romania;

- CNADNR identified that a lack of flexibility in terms of signing off project variation orders is a problem for a number of transport major projects. For example, a project may rely on a Feasibility Study which is lacking in one or more areas, and changes to the design during project implementation therefore provide an opportunity to enhance the project. However, currently a variation order requesting these changes is likely to be refused by the managing authority on the basis that it represents a change to the submitted design and is therefore not eligible. Greater flexibility to make design changes within the agreed scope and budget for a project would, in CNADNR’s view, improve the efficiency of delivery and result in better quality projects; and

- The Cernavoda to Constanta project was affected by issues related to expropriation. During project development, the policy on land acquisition was different to the current policy and it was very hard to work through and often contracts were signed prior to receipt of the expropriation permits. The new rules on expropriation should prevent these issues from occurring on future projects.

Financial sustainability

There is no plan to toll the Cernavoda to Constanta motorway or apply user charges, so comments on financial sustainability are limited to maintenance and operation costs and the residual value of the scheme.

The maintenance and operational costs are considered reasonable by the evaluators, within the context of the standards framework adopted, and will be the responsibility of the final beneficiary (CNADNR). These costs will be covered from the national budget, and whilst this promises financial sustainability, case study discussions with JASPERS indicated that the lack of a maintenance strategy in Romania to-date has compromised the maintenance of parts of the road network.
4 Romania: Rehabilitation of national road DN6 Alexandria – Craiova

4.1 Case study summary

The rehabilitation of the 127 km section of National Road 6 (DN6) between Alexandria and Craiova consists of the modernisation of the existing alignment of the DN6 in order to provide an enhanced quality of route and to improve safety over this section. The work was undertaken in three Lots: Lot 1 was completed in November 2013; Lot 2 is still to be completed (estimated completion is in spring 2016); and, Lot 3 was completed in June 2013.

The DN6 is part of the TEN-T network, forming part of the Rhine – Danube corridor that connects the central regions around Strasbourg and Frankfurt via Southern Germany to Vienna, Bratislava, Budapest and finally the Black Sea.

The most recent Feasibility Study of the project was undertaken by INOCSA Ingegneria in 2008/2009. The scope of this study was limited to updating previous feasibility work and considering a ‘without project’ case (consisting of routine and periodic maintenance) and the ‘with project’ case. The project application highlights the contribution of the project to meeting the requirements of EC Directive 96/53 for Romania’s TEN-T network. The need to satisfy them was the key factor in the selection of a large proportion of major transport projects for European funding during the 2007 -2013 programming period.

The Lots 1 and 3 of the project were implemented in line with the construction timetable set out in the application. Lot 2 was due to be completed alongside Lots 1 and 3 in 2013, so is at least two years behind the published programme.

With respect to the forecasting, a comparison of the real GDP growth forecasts applied in the demand analysis against outturn values and forecasts from Eurostat indicates that the assumptions made were optimistic and exceed the outturn and Eurostat forecast real GDP values. Since Lot 2 remains under construction it is not possible to examine outturn traffic data for the project; however traffic counts indicate that between 2005 and 2010 traffic along the route grew considerably in two out of the three locations examined as part of this case study.

Accident data for the route indicate that in 2012 (the latest year that records are available) the number of accidents on the route was greater than the average of the four years preceding construction. The number of serious casualties was also above average in 2012, whilst the number of fatalities was 33% lower than average. Given that rehabilitation work was underway on all three Lots in 2012, no conclusion on the impact of the completed project on accidents should be drawn from these data.

The financial analysis predicted an EBCR of 2.28. An outturn cost is not available, but sensitivity testing and risk analysis on the project indicated that reasonable changes to key project variables did not present a risk to the project objectives or value for money.
4.2 Introduction

Introduction

Table 4.1 contains a list of the key stakeholders who were interviewed regarding the rehabilitation of DN6\(^2\). The purpose of each interview was to explore particular issues, assumptions or changes in project context, and gain a better understanding of the project implementation and operation.

Table 4.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Transport and Infrastructure, Head of Strategy Directorate</td>
<td>The Romanian Ministry of Transport is the agency of government which establishes transport strategy and national policy. It acts as the State Authority for transport and infrastructure.</td>
</tr>
<tr>
<td>Managing Authority for SOP-T, under Ministry of Transport</td>
<td>The Sectoral operational programme &quot;Transport&quot; (SOP-T) 2007-2013 is the strategic instrument which establishes the priorities, objectives and financial allocation for the development of the transport sector in Romania with community aid. The Managing Authority is responsible for projects funded under SOP-T in the 2007-2013 programming period and will take the same role for projects funded in the 2014-2020 programming period.</td>
</tr>
<tr>
<td>CNADNR – National Company in charge of Roads Administration</td>
<td>The National Company of Motorways and National Roads in Romania is the entity responsible for the administration of strategic roads in Romania, operating under the Romanian Ministry of Transport. CNADNR is the final beneficiary of the DN6 Alexandria to Craiova rehabilitation project.</td>
</tr>
<tr>
<td>JASPERS (Joint Assistance to Support Projects in European Regions)</td>
<td>JASPERS provided support to the Romanian authorities in their application for European ERDF funding for the rehabilitation of DN6. This support included reviewing Feasibility Study and Application Form outputs in order to assess their compliance to support an ERDF application, support in the preparation of the financing application and participating in Steering Committees when requested by the client. In addition to the support on this project, JASPERS provide a range of support to the Romanian authorities and therefore have knowledge of the wider policy context of the project.</td>
</tr>
</tbody>
</table>

\(^2\) Rehabilitation of DN6, 2009RO161PR048, sectoral operational programme Transport, 2007RO161PO003.
Summary of the project

The DN6 is part of the Rhine – Danube corridor that connects the central regions around Strasbourg and Frankfurt via Southern Germany to Vienna, Bratislava, Budapest and finally the Black Sea (Figure 4.1). The project was delivered with a financial contribution from the European Regional Development Fund.

Figure 4.1 TEN – T Rhine – Danube corridor

The rehabilitation of a 127 km section of the DN6 between Alexandria and Craiova was undertaken in three Lots, determined by the county boundaries crossed (Figures 4.2 and 4.3):

- Lot 1 (Teleorman County) – completed in November 2013;
- Lot 2 (Olt County) – not complete due to delays following contractor issues. Estimated completion during 2016; and
- Lot 3 (Dolj County) – completed in June 2013.
The rehabilitation has been developed to the following technical standards: single-carriageway with a maximum road width of 10 m and an 11.5 t/axle maximum load. The carriageway is generally 7 m in width with provision of shoulders of 1.5 m. Seventeen structures have been rehabilitated/constructed as part of the scheme, with

Source: Rehabilitation of DN6 Alexandria – Craiova Cohesion Fund Application (December 2012)
75 new culverts also provided. Six parking locations are provided along the length of the scheme. The highway design speed varies between 25 and 100 km/h depending upon conditions (urban or interurban).

The project is technically independent; however, it has been developed alongside two complementary schemes which should enhance the functionality and benefits of the rehabilitation:

- The Caracal bypass; and
- The Alexandria bypass.

The Alexandria bypass has been completed and open to traffic since 2013. The Caracal bypass construction was affected by the same contractor issues as Lot 2 of the DN6 rehabilitation. Construction re-commenced at the end of 2014 and is ongoing.

**Project selection**

Romania did not have a national transport strategy in place at the time of the selection of projects for the 2007-2013 programming period. In the years preceding, Romania had been preparing for EU accession (2007) by developing projects to meet the requirements of EC Directive 96/53. In some cases this required new sections of highway construction, but in the majority of cases rehabilitation of existing highways was the chosen method of meeting the Directive.

Prior to accession, funding for projects included a European loan (for example from the EIB) or an application through the ISPA. When Romania started developing projects for their 2007-2013 operational programmes, the priorities were still clearly defined by the need to meet EC Directive 96/53 and also to complete projects aligned with the TEN-T priority axes in Romania. For this reason project selection was in many ways straightforward: for the highway networks, projects were prioritised because of their location on the TEN-T network, or because there was a requirement for rehabilitation/improvement of national road sections forming part of the TEN-T network. Some technical selection parameters were considered in the prioritisation process, but essentially the list of projects was evident and this was generally accepted by all parties.

In the case of the DN6, the poor condition of the pavement provided a reason to prioritise this project, as it forms part of Romania’s national road network and the extended TEN-T network.

**4.3 Project context and implementation**

**Objectives**

The socio-economic objectives for the project were set out in the 2010 Application Form. The principal objectives related to the improvement of travel conditions for goods and passengers, both within the study area and on the wider transport network:

- Ensure, by 2013, the rehabilitation of 127 km of modern connection between Alexandria and Craiova which would accommodate the forecast road user demand;
• Reduce by 2013 the average travelling time between Alexandria and Craiova from 149 minutes to 102 minutes;
• Reduce by 2013 the number of road fatalities and serious accidents along the route by 20%;
• Improve the accessibility of the region (qualitative); and
• Improve quality of life for the communities affected by the project (qualitative).

Policy context
The rehabilitation of the DN6 between Alexandria and Craiova has been delivered under Romanian operational programme Transport, Priority Axis 2: Modernisation, and development of the national transport infrastructure outside the TEN-T priority axes aiming at a sustainable national transport system.

This priority axis aims at modernising and developing road, rail, water and air transport infrastructure located on the national network outside the TEN-T priority axes and promotes an appropriate balance between modes of transport.

Its objective is to increase passenger and freight traffic with a higher degree of safety, speed and quality of service including rail inter-operability; in line with the Cohesion Policy’s objective of developing secondary network connections.

The project Application Form highlighted an urgent requirement to improve pavement conditions on TEN-T roads because of the application of an EC Directive. Although the project is not situated on a TEN-T priority axis it is located on the extended TEN-T network (as defined in the pre-2013 classification of the TEN-T) and from January 2007 all TEN-T routes were opened up to vehicles compliant with EC Directive 96/53. This included trucks with standard axle loadings up to 11.5 t. By consequence, the reconstruction/rehabilitation of sections of the TEN-T that had sub-standard pavement or pavement currently in poor condition became more urgent.

Project implementation
The rehabilitation works commenced in 2011 and were completed in September 2013 for Lot 1 and April 2013 for Lot 3. This construction period corresponded with the 24 month construction period timetabled in the project application. Lot 2 has been delayed by contractor issues and is expected to be completed by the end of 2015. The latest project application estimated that the project cost will be €228 mn, with €156.6 mn being provided from Cohesion Policy funding.

The main contract was let in three lots, dividing the project according to the boundaries of the counties it passes through. This approach to transport construction is common in Romania as the majority of local construction companies would not have the resource capacity to undertake very large projects alone. The approach also provides a mechanism for distributing construction work amongst a larger number of companies.
The contracts for the rehabilitation of DN6 Alexandria to Craiova were awarded in a single stage tender (i.e. there was no pre-qualification exercise) on the criterion of lowest price.

This approach was developed to counter problems which had occurred with disputes at the contract award stage with previous projects relying on a combination of technical capability and price as award criteria. Tender results were often contested under this result as contractors suspected that their competitors had exaggerated their technical capacity to undertake the work.

The approach to procurement in the 2014-2020 programming period will be in line with the 2014 EU Procurement Directives which came into force at EU level on 17 April 2014.

The contract applied to each of the DN6 lots was a red FIDIC contract (see footnote 7 on page 17). The contractual issues affecting Lot 2 were related to the contractor’s business rather than the specifics of delivering the DN6 Lot 2 contract. During the construction (while the contractor was on site) the contractor became insolvent and construction on the Lot 2 section was therefore halted until a new contractor was appointed.

The resulting delays have pushed the construction programme beyond the limits of the 2007-2013 programming period. As a result, the major project will be phased as follows. Phase 1 (Lots 1 and 3) will be funded from the 2007-2013 programming period and a revised project application will be submitted for these lots to reduce the funding allocation. Phase 2 (Lot 2) will seek funding from the 2014-2020 programming period via a new project application. Construction for Lot 2 is now in progress again with a new contractor and should be completed by spring 2016.

The consequence of phasing this project (and others not completed during the 2007-2013 programming period) for the Romanian Transport Strategy as a whole is that the amount of EU funding available to new projects in the 2014-2020 programming period will be reduced.
4.4 Demand analysis

Review of assumptions

The economic and financial appraisals of the rehabilitation of DN6 were heavily dependent on the forecast travel demand and the consequent time savings. A high level summary of the demand analysis carried out for the rehabilitation of DN6 is shown in Table 4.2.

Table 4.2 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
<th>A mitigating factor is that the project’s traffic study calculates traffic growth on the basis of population and real GDP projections.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No demographics figures or forecasts are presented in the Application Forms. The Feasibility Study states that the road rehabilitation will create new jobs, although no figures and forecasts are given.</td>
<td>R</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
<th>Project selection is on the basis that it is situated on the TEN-T network and due to the requirements of EC Directive 96/53.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Feasibility Study only discusses rehabilitation of the DN6 in reference to national objectives. VISUM highway model applied.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer Behaviour Summary</th>
<th>Scoring</th>
<th>The methodology applied is adequate but does not consider the impact of variable demand.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand analysis was undertaken using a VISUM highway model based on 2005 CESTRIN data and relying on national forecasts which did not consider newly generated traffic.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability/Tariffing Summary</th>
<th>Scoring</th>
<th>N/A. Schemes where tariffing is not applicable have been scored amber.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No tolling element to this scheme, hence no consideration of tariffing or affordability issues.</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>


The following are the key assumptions used in the generation of the demand analysis and subsequent cost benefit analysis:

- Real GDP growth rates: These have been presented in the Traffic Report, by zone representing county-level GDP forecasts. No aggregation is provided, so the lowest and highest year-on-year percentages are listed based on the data provided:
  - 2005 to 2020: low 3.5%, high 6.7%; and
  - 2020 to 2028: low 2.5%, high 5.7%.
- Demand Assumptions: 2005 traffic flows on the DN6 are provided below together with forecast traffic flows for 2028 for the ‘without project’ scenario and two ‘with project’ scenarios: with and without the completion...
of the Caracal and Alexandria bypasses. All traffic flows provided are two-way annual average daily traffic flows (Table 4.3);

- Journey time assumptions: Reduction in average travel time over the whole length of the scheme (127 km) from 149 minutes (51 km/h) prior to the rehabilitation to 102 minutes (75 km/h) after project completion; and
- Reduction in road accident assumptions: A reduction in the number of accidents of 20% as a result of the implementation of the project.

### Table 4.3 Base year and forecast demand flows (AADT)

<table>
<thead>
<tr>
<th>Route Section</th>
<th>Without Project Scenario</th>
<th>With Project Scenario (without Alexandria or Caracal bypasses)</th>
<th>With Project Scenario (with Alexandria and Caracal bypasses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed flows from 2005 CNADNR census</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craiova – Caracal</td>
<td>2,700</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Caracal – Rosiori de Vede</td>
<td>3,000</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Rosiori de Vede – Alexandria</td>
<td>6,300</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2028 forecast flows</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craiova – Caracal</td>
<td>7,600</td>
<td>8,600</td>
<td>9,400</td>
</tr>
<tr>
<td>Caracal – Rosiori de Vede</td>
<td>5,300</td>
<td>6,300</td>
<td>7,200</td>
</tr>
<tr>
<td>Rosiori de Vede – Alexandria</td>
<td>10,300</td>
<td>11,400</td>
<td>12,300</td>
</tr>
<tr>
<td>Overall Percentage growth 2005-2028</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craiova – Caracal</td>
<td>181%</td>
<td>219%</td>
<td>248%</td>
</tr>
<tr>
<td>Caracal – Rosiori de Vede</td>
<td>77%</td>
<td>110%</td>
<td>140%</td>
</tr>
<tr>
<td>Rosiori de Vede – Alexandria</td>
<td>63%</td>
<td>81%</td>
<td>95%</td>
</tr>
<tr>
<td>Average Annual Percentage growth 2005-2028</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Craiova – Caracal</td>
<td>4.6%</td>
<td>5.2%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Caracal – Rosiori de Vede</td>
<td>2.5%</td>
<td>3.3%</td>
<td>3.9%</td>
</tr>
<tr>
<td>Rosiori de Vede – Alexandria</td>
<td>2.2%</td>
<td>2.6%</td>
<td>3.0%</td>
</tr>
</tbody>
</table>
Verification of assumptions

A comparison of the national real GDP growth assumptions applied in the modelling and appraisal against Eurostat published data and forecasts for Romania indicates that the projected assumptions are above the actual observed growth and Eurostat forecasts. Figure 4.4 indicates that initial growth was higher than predicted to some extent offsets the impact of the global economic downturn on Romanian GDP and that current Eurostat forecasts map below the lower end of the ranges covered by the data provided in the Traffic Report with the two forecasts gradually converging as the Traffic Report long-term forecast growth rate is 2.5% per annum compared with 3.5% per annum for Eurostat.

Figure 4.4 Comparison of real GDP

![Graph showing comparison of real GDP growth rates](image)

No outturn traffic demand data are available for the scheme because Lot 2 is still incomplete. However, 2010 data from the five-yearly survey in Romania are available for comparison against the 2005 data used in the demand analysis for the project (and presented earlier in Table 4.3). Table 4.4 presents the 2005 data alongside the 2010 data indicating that there has been considerable traffic growth at two of the three reported locations between 2005 and 2010. This information provides the basis of a comparison against outturn data once this becomes available.

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28 Eurostat Table TEC00115 of Real Gross Domestic Product growth
Table 4.4 Base year and forecast demand flows (AADT)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Craiova – Caracal</td>
<td>2,700</td>
<td>3,400</td>
<td>+26%</td>
<td>4.7%</td>
</tr>
<tr>
<td>Caracal – Rosior de Vede</td>
<td>3,000</td>
<td>4,600</td>
<td>+53%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Rosior de Vede – Alexandria</td>
<td>6,300</td>
<td>5,500</td>
<td>-13%</td>
<td>-2.7%</td>
</tr>
</tbody>
</table>

Accident data are available from 2007-2012 for the sections of the DN6 corresponding with the rehabilitation (Table 4.5). As with the demand data, these data do not extend to the period after the completion of Lots 1 and 3, but they do provide useful data for trend analysis once outturn accident data are available.

Table 4.5 2007–2012 accident data

<table>
<thead>
<tr>
<th>Year</th>
<th>Slight Injuries</th>
<th>Serious Injuries</th>
<th>Fatalities</th>
<th>Total Accidents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>65</td>
<td>24</td>
<td>16</td>
<td>81</td>
</tr>
<tr>
<td>2008</td>
<td>70</td>
<td>13</td>
<td>13</td>
<td>81</td>
</tr>
<tr>
<td>2009</td>
<td>88</td>
<td>20</td>
<td>23</td>
<td>86</td>
</tr>
<tr>
<td>2010</td>
<td>45</td>
<td>17</td>
<td>14</td>
<td>59</td>
</tr>
<tr>
<td>2011</td>
<td>Construction in progress</td>
<td>51</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>2012</td>
<td>75</td>
<td>24</td>
<td>11</td>
<td>80</td>
</tr>
<tr>
<td><strong>Annual Average (2007-2012)</strong></td>
<td><strong>65.7</strong></td>
<td><strong>19.7</strong></td>
<td><strong>15.0</strong></td>
<td><strong>74.3</strong></td>
</tr>
<tr>
<td><strong>Annual Average (2007-2010)</strong></td>
<td><strong>67.0</strong></td>
<td><strong>18.5</strong></td>
<td><strong>16.5</strong></td>
<td><strong>76.8</strong></td>
</tr>
</tbody>
</table>

The forecast reduction in fatal and serious accidents is 20% by 2013 (as stated in the project objectives, A.5.2 of the project application). Whilst the data in Table 4.5 do not allow for direct comparison against these forecasts we can observe that in 2012:

- The number of recorded serious injuries (24) was above the average recorded for the four years before construction commenced (18.5);
- The number of recorded fatal injuries (11) was 33% below the average recorded for the four years before construction commenced (16.5); and
- The number of recorded accidents (80) was above the average recorded for the four years before construction commenced (76.8).

Trend analysis is generally required to understand road safety impacts (to remove the influence of expected variance within any given year), and full conclusions on the
impact of the scheme on accidents should ideally be based upon a comparison of a five-year period before the rehabilitation with a five-year period after.

4.5 Financial analysis

Overview of financial analysis

The financial analysis of the rehabilitation of the DN6 included three key elements: the capital cost; residual value and operating costs. There are no revenues associated with the project as no tolling is proposed on the rehabilitated route.

The exact final capital cost of the project is not yet known. The best current estimate of the final cost, along with previous estimates, is provided in Table 4.6 below. In addition, the costs have been adjusted to 2013 prices to provide a basis for comparison.

Table 4.6 Cost of rehabilitation of DN6 - € mn

<table>
<thead>
<tr>
<th>Stage</th>
<th>In price year</th>
<th>Estimated in 2013 prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008 Feasibility Study and CBA Report (assumed 2008 prices)</td>
<td>209</td>
<td>264</td>
</tr>
<tr>
<td>2010 Project Application (assumed 2010 prices)</td>
<td>228</td>
<td>258</td>
</tr>
</tbody>
</table>

Investment costs from earlier feasibility activities are not available either from the Commission’s files provided or from stakeholders interviewed. It is only possible therefore to track the profile of the total project investment cost from 2008. Taking allowance of inflation, total projected costs decreased by 2% in the period from the 2008 Feasibility Study (and accompanying CBA) to the 2010 project application (updates to the project application to December 2012 include the same stated investment cost). Discussions with the Ministry of Transport and CNADNR indicated that, despite the contractual issues with Lot 2 of the project, it is expected that the total investment cost will remain close to the estimate in the project application.

The Cohesion Policy funding was expected to contribute €156.6 mn to the cost of the project. Since construction has not been completed and because the project will be phased into the 2014-2020 programming period, the actual final contribution has yet to be determined. Discussions with the Ministry of Transport and CNADNR indicated that the funding sought is not expected to change by any substantial amount. Estimates of contributions to-date are shown in Table 4.7.

Table 4.7 Contributions to cost of rehabilitation of DN6 4

<table>
<thead>
<tr>
<th>Source</th>
<th>€ mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERDF</td>
<td>156.6</td>
</tr>
<tr>
<td>Romanian State</td>
<td>71.6</td>
</tr>
<tr>
<td>Total Budget</td>
<td>228.2</td>
</tr>
</tbody>
</table>

29 Estimated levels adjusted based on inflation (using Eurostat HICP index for Romania) – for comparison purposes only.
30 Source: Major Project Application
Economic analysis

The 2008 cost benefit analysis predicted a net present value of €156.8 mn and an EBCR of 2.28. The breakdown of costs and benefits associated with the scheme is shown in Figure 4.5. This shows that 63% of the benefits of the scheme were predicted to be travel time savings for users, whilst the investments costs were estimated to be 93% of the total project costs.

Figure 4.5 Breakdown of forecast economic benefits and costs

The composition of forecast benefits is in line with expectations for this type of highway project, in that travel time savings comprise the majority of benefits (63%). The calculation of operating and maintenance costs for highway projects was again undertaken in accordance with a Romanian regulatory framework, which meant that estimates were consistent across projects. The same systematic biases and institutional factors were therefore identified as those in the Cernavoda to Constanta project (see Section 3).

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31 The appraisal was based upon a 25 year evaluation period with a two-year period of works and a discount rate of 5.5%. The price base year was 2008.
32 Source: 2008 Cost Benefit Appraisal
**Financial sustainability**

There is no plan to toll the DN6 or apply user charges once the rehabilitation is complete and so comments on financial sustainability are limited to maintenance and operating costs and the residual value of the scheme.

In the financial analysis the scheme residual value was estimated at 20% of the investment costs. JASPERS considered that, given the residual value of other road and motorway projects in Romania, this value was not unreasonable.

The maintenance and operating costs are considered reasonable and will be the responsibility of the final beneficiary (CNADNR). These costs will be covered from the national budget, and whilst this promises financial sustainability, case study discussions with JASPERS indicated that the lack of a maintenance strategy in Romania to-date has compromised the maintenance of parts of the road network.
5 Bulgaria: Trakia Motorway Bulgaria (Lots 2, 3 and 4)

5.1 Case study summary

The Trakia Motorway project consists of 116 km of two-lane motorway between Stara Zagora and Karnobat in the south west of Bulgaria. The project completes the Trakia Motorway from Sofia to the Black Sea port of Burgas.

The project was implemented in three sections (Lots 2, 3 and 4) with each section progressing independently but in parallel. Construction commenced for each of the three sections between June and October 2010. Lots 2 and 3 opened in mid-2012 with Lot 4 opening in July 2013.

The forecast cost of the project was €363 mn with the final cost estimated to be €261 mn. The reduction in cost compared to the level forecast is likely to be due to a combination of a high forecast cost (based on international experience), the premium tenderers placed on winning one of the contracts (in order to gain experience) and the use of cost as the principal method of tender evaluation.

Since opening, the traffic using the scheme has been lower than forecast by circa 25%. It is notable that these traffic figures were measured after a period of economic slowdown in both Bulgaria and the wider region.

A very strong economic case was forecast for the project, with a EBCR of 4.2. The reduced capital cost and demand are estimated to largely offset each other. This implies a strong economic case for the project remains.
5.2 Introduction

Introduction

This section presents the case study for the completion of the Trakia Motorway in Bulgaria. Table 5.1 contains a list of the key stakeholders who were interviewed regarding the project. It is noted that the Bulgarian authorities were particularly open and helpful in providing information on the Trakia Motorway project. Their assistance in this regard is appreciated.

Table 5.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Transport, Information Technology and Communications</td>
<td>The Ministry of Transport, Information Technology and Communications (MTITC) is the Managing Authority (MA) for the operational programme on Transport 2007-2013 under which the Trakia Motorway project has been implemented. The ministry is responsible for the state transport policy and the distribution and control of funds allocated for transport from the state budget. The Coordination of Programmes and Projects Directorate and the National Transport Policy Directorate were met separately.</td>
</tr>
<tr>
<td>Road Infrastructure Agency</td>
<td>The Road Infrastructure Agency (RIA) is the beneficiary for the Trakia motorway project. It is an agency of the Ministry of Regional Development and Public Works and is responsible for the development of the motorway and national road network.</td>
</tr>
<tr>
<td>Ministry of Regional Development and Public Works</td>
<td>The Ministry of Regional Development and Public Works has overall responsibility for building and maintaining the road network in Bulgaria. The road network in Bulgaria falls under the remit of this ministry and its agency (RIA). The ministry is not responsible for transport policy which is the remit of MTITC.</td>
</tr>
<tr>
<td>JASPERS (Joint Assistance to Support Projects in European Regions)</td>
<td>JASPERS provided technical assistance to the Bulgarian authorities in their application for European funding for the Trakia Motorway. This support included assistance in drafting the project application, compiling the cost benefit analysis and identification of key success/risk elements of the project. In addition to the support on this project, JASPERS provide a range of support to the Bulgarian authorities and therefore have knowledge of the wider policy context of the project.</td>
</tr>
</tbody>
</table>

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33 Trakia Motorway Bulgaria (Lots 2, 3 and 4) – 2010BG161PR002; operational programme on Transport (Bulgaria) 2007-2013, 2007BG161PO004
Summary of the project

The Trakia Motorway project is a 116 km two-lane motorway completing the link from Sofia to Karnobat, and thereby to Burgas on the Black Sea. The project was delivered with a financial contribution from the Cohesion Fund.

The project was constructed in three sections (Lots 2, 3 and 4) from Stara Zagora to Karnobat. The sections from Sofia to Stara Zagora and from Karnobat to Burgas were previously completed in stages between 1984 and 2007. The full Trakia Motorway is shown in Figure 5.1 below with Lots 2, 3 and 4 highlighted in red.

Figure 5.1 Trakia Motorway project

The project is on the TEN-T forming part of the Orient/East-Med Corridor and forms the southern section of the ‘backbone’ of roads linking Sofia and the Black Sea ports of Burgas and Varna. It therefore completes a key national route providing access to the Black Sea. The project was completed in July 2013 when the final section (Lot 4) was opened.

Project selection

The development of the Trakia Motorway was studied over many years, with the corridor from Stara Zagora to Burgas analysed in the period from 1976 to 1991. Studies carried out in this period concluded that the capacity of the existing road would be exhausted by 1990. In order to meet demand, a new motorway from Stara Zagora to Burgas was recommended. A further study in 1998 examined a range of alternative road types. These included:

- Minimum measures (i.e. routine maintenance of existing roads);
- Additional improvements of existing route;

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34 Source: Cost Benefit Analysis, Completion of Trakia Motorway, Stara Zagora – Karnobat (May 2010)
35 PATPROEKT OOD was the principal consultant carrying out these studies
36 Study and Assessment of the Economic and Financial Efficiency for Construction of Trakia Motorway (Orizovo – Jitarovo) and Cheerno More Motorway (Jitarovo - Priselci) (1998)
Motorway with initially one lane in each direction; and

Motorway with two lanes in each direction.

The study concluded with a preference for a two-lane motorway. This recommendation was further confirmed in the General Transport Master Plan for Bulgaria published in 2010.

The 170 km section of motorway from Sofia to the village of Plodovitovo was completed by 2005. The remaining length of the Trakia Motorway was split into five Lots with the easterly section completed in 2006 (Lot 5) and the westerly section (Lot 1) in 2007. The remaining three lots comprised the route from Stara Zagora to Karnobat as follows:

- Lot 2: Stara Zagora to Nova (32 km);
- Lot 3: Nova Zagora to Yambol (36 km); and
- Lot 4: Yambol to Karnobat (48 km).

Route alignment variants were examined for each section (Lot). The final route alignment was based on a range of factors including:

- Technical;
- Economic (including proximity to industrialised areas);
- Environmental (including reduced impact on fertile agricultural land); and
- Financial (i.e. lower capital, maintenance and option costs).

The final route type and alignment received general support from national and local authorities and the public.

5.3 Project context and implementation

Objectives

As detailed in the project Application Form, the stated objectives of the project were:

- Improvement of the performance of the national and Trans-European network by completing the southern part of the Bulgarian motorway ‘backbone’;
- Increasing the travel speeds and reducing travel time;
- Decreasing the number of accidents;
- Reducing congestion by eliminating capacity constraints and avoiding populated areas;

37 General Transport Master Plan for Bulgaria (April 2010)
• Accommodating the forecasted increase of passengers and freight demand, both local and international, due to the development of the area and of the economy as a whole;

• Reducing the negative environmental impact and the exposure of the people in the populated areas along the route to air pollution, noise and traffic accidents; and

• Providing harmonised travelling conditions and improved services to users.

Policy context

The concept of a transport ‘backbone’ in Bulgaria was first developed in the second half of the last century. The ‘backbone’ includes a northern link from Sofia to Varna (Hemus Motorway), a southern link from Sofia to Burgas (Trakia Motorway) and a link between Varna and Burgas (Cherno More Motorway).

In the 1980s and 1990s, this plan was expanded to include a link from Sofia to the southern borders with Greece (Struma Motorway), a link from the Trakia motorway to the southern border with Turkey (Maritsa Motorway) and an extension of the Hemus/Trakia motorways from Sofia in a westerly direction to the border with Serbia. This planned motorway network is shown in Figure 5.2.

Figure 5.2 Bulgarian motorway network

The General Transport Master Plan for Bulgaria published in 2010 was developed in order to establish “a strategic and coherent base of technical data, transport models
and multimodal technical studies for project identification for long and medium term investment programming in the transport sector in Bulgaria.\textsuperscript{38}

The development of the General Transport Master Plan for Bulgaria included the analysis of the existing transport system, identification of weaknesses to be overcome, forecasting of future transport demand, option identification and appraisal and identification of key transport priorities. The General Transport Master Plan identifies the completion of the Trakia Motorway, from Sofia to Burgas, as Bulgaria’s highest priority transport investment project.\textsuperscript{39}

The Trakia Motorway is part of TEN-T. At the time the Trakia Motorway was being planned, the sections of the Trakia Motorway completed under this project were part of Pan-European transport corridor VIII which starts at the Italian Ports of Bari and Brindisi passing through Durres/Vlora, Tirana, Skopje, Sofia and Burgas/Varna. In October 2013, the European Commission published a major update of the TEN-T identifying nine major corridors that will act as the backbone for transportation in Europe.\textsuperscript{40} The Trakia Motorway is part of the Orient/East-Med Corridor.

**Project implementation**

The project was implemented in three sections (Lots 2, 3 and 4), with each section progressing independently but in parallel.

Consideration was given to combining all three sections into a single scheme. However, it was considered that the scale of this scheme would have been beyond the capacity of potential contractors. The capacity of such contractors was constrained by a combination of financial, technical and staff limitations.

The development of the scheme as a public private partnership (PPP) was also examined by the authorities. This included a procurement process and the identification of a preferred tenderer. However, as this process was not in compliance with EU tendering rules, and there were difficulties envisaged in implementing a tolling system, it was decided to cancel the process and procure the scheme through traditional design and build contracts.

The acquisition of land required for the three sections commenced in 2004 and was completed in 2010. The completion of all land acquisition in advance of commencing construction significantly reduced the risk associated with the project. It is noted by the Ministry of Transport, Information Technology and Communications that legislation has subsequently changed making access to lands not directly acquired more restrictive, thus increasing the difficulties for construction companies. It is believed this was carried out to increase protection for landowners.

A separate contract was issued for each of the three sections for both construction and supervision resulting in six principal contracts. The preparation of tender documents took place from the end of 2009 into the first half of 2010. The procurement procedure was completed for all six contracts by August 2010.

\textsuperscript{38} See p. 1 http://optransport.bg/upload/docs/BGTMP_Final_Report_30_11_10_ENG_FINAL.PDF

\textsuperscript{39} See p. 111 http://optransport.bg/upload/docs/BGTMP_Final_Report_30_11_10_ENG_FINAL.PDF

\textsuperscript{40} See http://ec.europa.eu/transport/themes/infrastructure/news/ten-t-corridors_en.htm
The contracts used in the Trakia Motorway project were not standard international contracts (e.g. FIDIC). It was preferred to develop contracts for the project based on national legislation.

The outturn cost of constructing the three sections was circa 28% below the level forecast in the application. There are a number of potential reasons behind this difference. It is the evaluator's belief that the principal reason for the lower outturn costs was the adverse economic circumstances in 2008/9 which resulted in contractors offering exceptionally low prices in order to maintain their businesses. The selection of the winning contractor was based entirely on price, with other elements such as technical evaluation having no weighting. The RIA offered the explanation that the prices used in the project application were based on international experience, and so may not have fully incorporated the reduced costs associated with construction in Bulgaria. In addition, the Trakia Motorway project was one of the first in a pipeline of projects likely to be sanctioned after the accession of Bulgaria to the EU. The contractors considered the experience and knowledge gained in constructing one of the sections of the Trakia Motorway would provide a significant advantage in future projects, and consequently tendered at lower costs.

It is believed that the maturity of the project development, particularly completion of land acquisition, reduced the risk associated with the project. The construction contracts were also fixed price, apart from a force majeure provision, which limited contractors’ ability to claim for additional costs. The RIA stated that there was no evidence of sub-standard construction as a result of this procurement route. The conditions of contract included a 5 year guarantee for the wearing course.

The combination of these factors led to quite significant price competition and resulted in a lower than forecast construction cost associated with the project. However, it is unlikely that the combination of conditions that generated such a low cost will be repeated in the future.

Construction of all three Lots commenced between June and October 2010. There were additional works required on all three Lots that were not part of the original contracts. This included minor works associated with underground facilities (mainly water pipes) on Lots 3 and 4 and overhead high-voltage electricity lines (Lot 2). It is believed some of these additional costs may have been foreseen (and potentially avoided) if more recent surveys of the routes had been undertaken.

The most substantial work involved stabilisation works on 12 km of the Lot 4 section following exceptional, adverse weather conditions. This work was subject to a tender process and additional costs of circa €8 mn. These works resulted in a six month delay in the completion of Lot 4, which was finalised in July 2013. Lot 2 was completed on schedule in June 2012 and Lot 3 was completed ahead of schedule in July 2012.
5.4 Demand analysis

Review of assumptions

The economic and financial appraisals of the Trakia Motorway project were heavily dependent on the forecast demand: the number of vehicles using the scheme. A high level summary of the demand analysis carried out for the Trakia Motorway project is shown in Table 5.2 below.

Table 5.2 Thematic demand analysis

| Demographics Summary | Scoring | The data used was based on a combination of a country-wide strategic study, a 2004 study of the corridor and data on existing and forecast traffic on the route by the central laboratory for roads and bridges. |
| Competing Modes Summary | Scoring | The criteria used for route selection were considered reasonable. A full cost benefit analysis was carried out evaluating the impact of the project. |
| Consumer Behaviour Summary | Scoring | The methodology employed included the impact of the project on consumer behaviour including mode and route choice. |
| Affordability/Tariffing Summary | Scoring | A review is currently underway in order to determine the future method of funding road maintenance in Bulgaria. The outcome of this study will impact the financial sustainability of the project. |

Verification of assumptions

The level of use of the three sections of the Trakia Motorway project was forecast as part of the project appraisal. Table 5.3 provides a comparison between the forecast level of traffic and actual traffic using each section of the Trakia Motorway.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Lot 2</th>
<th>Lot 3</th>
<th>Lot 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stara Zagora to Nova</td>
<td>Nova Zagora to Yambol</td>
<td>Yambol to Karnobat</td>
</tr>
<tr>
<td>Forecast</td>
<td>19,585</td>
<td>22,474</td>
<td>24,742</td>
</tr>
<tr>
<td>Actual</td>
<td>16,457</td>
<td>17,652</td>
<td>16,294</td>
</tr>
<tr>
<td>Actual v Forecast</td>
<td>-16%</td>
<td>-21%</td>
<td>-34%</td>
</tr>
</tbody>
</table>

Source: Cost Benefit Analysis, Completion of Trakia Motorway, Stara Zagora – Karnobat, May 2010; Traffic survey results provided by Ministry of Transport, Information Technology and Communications.

Based on the data available to-date (shown above), the traffic levels using the scheme are below the levels forecast. This ranges from a 16% shortfall on the most westerly section (Lot 2) to a 34% shortfall on the most easterly section (Lot 4). On average the shortfall in traffic from that forecast is circa 25%.

It is noteworthy that all three sections have similar outturn levels of use, whereas the ex-ante forecast identified higher levels of use for the more easterly sections (3 and 4). The reasons, which can be considered systematic bias, for the difference between forecast and outturn demand fall into three broad areas:

- Insufficient or inaccurate base data;
- Inadequate modelling techniques; and
- Differences in external assumptions, in particular economic growth forecasts which drive overall traffic demand.

Of these three factors, the biggest driver of the difference between forecast and outturn traffic flows is likely to be the economic growth assumptions. Between 2008 (the base year for the model) and 2014, the forecast national economic growth, based on reliable sources including the IMF, World Bank and European Commission, was 24.7% (circa 3.7% annual average growth), whereas outturn growth was only 0.8% (circa 0.1% annual average growth). Thus, outturn national real GDP was only 80% of that forecast, and since the relationship between traffic growth and national GDP growth was more or less 1:1 over this period, the difference in national real GDP would account for the majority of the difference in traffic flows.

The forecast levels of growth for 2015 to 2030 are shown in Table 5.4. In addition the level of growth required from the observed 2014 traffic flows to realise the forecast level of traffic in 2030 is shown.

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41 Source: World Bank
42 80% figure is based on total GDP level (1.008/1.247)
Table 5.4 Forecast and required traffic growth rates

<table>
<thead>
<tr>
<th>Stage</th>
<th>Lot 2 Stara Zagora to Nova</th>
<th>Lot 3 Nova Zagora to Yambol</th>
<th>Lot 4 Yambol to Karnobat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast Annual Average Growth Rate 2015 to 2030</td>
<td>2.9%</td>
<td>2.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Required Annual Average Growth Rate to Achieve 2030 Forecast</td>
<td>4.0%</td>
<td>4.4%</td>
<td>5.4%</td>
</tr>
</tbody>
</table>

Source: Cost Benefit Analysis, Completion of Trakia Motorway, Stara Zagora – Karnobat, May 2010;

The forecast annual average growth rates are under 3% for each section of the Trakia Motorway. Bulgarian real GDP is forecast to grow at an average annual rate of 1.9% in the period 2015 to 2018\(^43\). In the longer term, a higher growth rate is expected; circa 2.4% annual average growth\(^44\). The regional GDP levels used in the traffic forecasting ranged from 2.2% to 5.6% for the period 2015 to 2030. The overall growth level is in the range 3% to 4%.

The level of real GDP growth currently forecast is therefore lower than that used in the cost benefit analysis. This implies that the level of economic benefits forecast in the cost benefit analysis may not be fully realised. The impact of the shortfall in traffic on the overall economic case for the project is discussed further in the following section.

In order to understand the potential reasons for the shortfall in observed traffic flows, the forecast and actual traffic volumes are examined by type of vehicle in Table 5.5.

Table 5.5 Forecast and actual traffic by type (2014)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Lot 2 Stara Zagora to Nova</th>
<th>Lot 3 Nova Zagora to Yambol</th>
<th>Lot 4 Yambol to Karnobat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cars</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecast</td>
<td>16,282</td>
<td>17,792</td>
<td>18,308</td>
</tr>
<tr>
<td>Actual</td>
<td>13,658</td>
<td>14,803</td>
<td>13,869</td>
</tr>
<tr>
<td>Actual v Forecast</td>
<td>-16%</td>
<td>-17%</td>
<td>-24%</td>
</tr>
<tr>
<td>All other Vehicles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forecast</td>
<td>3,304</td>
<td>4,682</td>
<td>6,434</td>
</tr>
<tr>
<td>Actual</td>
<td>2,799</td>
<td>2,849</td>
<td>2,425</td>
</tr>
<tr>
<td>Actual v Forecast</td>
<td>-15%</td>
<td>-39%</td>
<td>-62%</td>
</tr>
</tbody>
</table>

Source: Cost Benefit Analysis, Completion of Trakia Motorway, Stara Zagora – Karnobat, May 2010; Traffic survey results provided by Ministry of Transport, Information Technology and Communications.

The most noticeable conclusion from the table above is the difference between the forecast and actual numbers of non-car vehicles for Lots 3 and 4. It is also notable

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\(^{43}\) Source: Bulgaria National Reform Programme, 2015 Update

\(^{44}\) Source: Table 8.1 - Baseline Projections, Productivity in Bulgaria, Trends and Options (World Bank, May 2015)
that the numbers of both cars and other vehicles (including goods vehicles and busses) actually using the scheme is relatively consistent across all three sections.

The forecast traffic numbers for each section increased with distance from Sofia. The reason behind this is not clear from the information available. Stakeholders were not able to provide any insight into the asymmetrical nature of the shortfall – with the overall shortfall understood to be related to lower than forecast economic activity.

As noted, the actual traffic data from the scheme is after a period of economic slowdown in Bulgaria and the wider European region. The long-term relationship between the actual traffic volumes using the scheme and the level forecast will only be possible to discern after a number of years operation and when the economy of the wider region has recovered.

### 5.5 Financial analysis

#### Overview of financial analysis

The financial analysis of a major project includes three key elements: namely the capital cost; operation and maintenance cost; and revenues. The forecast and actual capital cost of the project is provided in Table 5.6 below, along with the financial contribution from the Cohesion Fund.

#### Table 5.6 Cost of Trakia Motorway

<table>
<thead>
<tr>
<th></th>
<th>€ mn</th>
<th>Cohesion Fund contribution € mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecast Cost</td>
<td>362.6</td>
<td>286.2</td>
</tr>
<tr>
<td>Estimated Actual Cost</td>
<td>261.4</td>
<td>Not known</td>
</tr>
</tbody>
</table>

Source: Project application; Ministry of Transport, Information Technology and Communications; Note: Forecast cost excludes contingencies, estimated actual cost includes land acquisition costs.

The actual cost of the project is circa 28% below the level forecast in the project application. The Bulgarian authorities estimated that the capital costs of projects during the 2007-13 programming period were on average 20% lower than expected. The capital cost reductions between the levels in the project applications and post-tender process are shown in Figure 5.3 for a range of Bulgarian road projects. The realisation of a tender cost lower than the forecast cost for the Trakia Motorway is in keeping with other major projects and a systematic bias.
A key driver of this difference is believed to be the economic circumstances at the time which led contractors to bid at low prices. Given the forecast costs were higher than those realised from the tender process for a number of projects, this could be considered a systemic bias. However, it is noted that these low costs were based on a combination of economic circumstances and are not likely to be repeated in the future.

In the case of the Trakia Motorway, it is understood that tenderers put a premium on being involved with a view to securing experience and knowledge leading to future work. The reduced risk associated with the project (e.g. due to land acquisition being completed) and the high weighting given to cost in the evaluation were further factors driving costs down.

It should be noted that the Bulgarian Lev is pegged to the Euro and therefore there has been no exchange rate impact over the period.

The construction works carried out are guaranteed by the contractors for periods ranging up to ten years. However, the maintenance of the Trakia Motorway project is the responsibility of the RIA. The maintenance costs were estimated to be circa €12,500 per km per annum. Maintenance spending to date is circa €7,000 per km per annum. Although the actual cost appears to be 50%-60% of the forecast cost, this is not considered an accurate measure of the long-term outcome. The RIA has indicated that the current budget for road maintenance is severely constrained. The budget for maintenance of Bulgaria’s national road network is circa €60 mn, for 19,000 km, or €3,200 per km. As such, the current level of maintenance expenditure is not viewed as being reflective of the long-term need. The forecast cost included in the project application is still viewed as the best forecast of maintenance cost.

The final element of the financial analysis is revenue. As the Trakia Motorway does not have charges based on use (e.g. tolls), there is no direct revenue attributable to the motorway. There is a charge per week, month or year (i.e. a vignette) which is charged to road users on the network as a whole. This revenue is used to maintain and improve roads across the network (including the Trakia Motorway).
Economic analysis

The economic case for the Trakia Motorway project is very strong with an economic rate of return (ERR) of 39.6%, a net present value (NPV) of €1.52 b (2009) and a BCR of 4.2.

The breakdown of the costs and benefits are shown in Figure 5.4 below with the large difference between total costs and total benefits illustrating the high NPV associated with this project.

Figure 5.4 Breakdown of forecast economic benefits and costs

It is notable that a significant proportion of the costs (circa 42%) are associated with additional vehicle operating costs and emissions due to the Trakia Motorway project. This is due to the additional traffic generated by the scheme. The traffic forecasts indicate that circa two-thirds of the traffic using the motorway is diverted from other roads whereas one-third is traffic generated as a result of the provision of the scheme.

When examining the outcomes of the scheme in the context of the economic appraisal, the following has been found:

- A shortfall in traffic of circa 25% from that forecast;
- A reduction in capital cost of circa 28% from that forecast; and

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45 Source: Cost Benefit Analysis, Completion of Trakia Motorway, Stara Zagora – Karnobat (May 2010); Note: Values of time were not escalated in line with GDP/head, as is the usual practice.
• No conclusive change in the forecast maintenance cost.

Should this remain the case for the lifetime of the project, the net result would be a negligible change in the economic case for the project with the EBCR remaining at the same level (4.2). Based on the initial outturn data available, it can therefore be concluded that the strong economic case for the project remains. Should traffic volumes grow at a rate greater than forecast (i.e. at 3% or above), the economic case would be even further enhanced.

Financial sustainability

The financial sustainability of the Trakia Motorway project is a balance between the cost of the required maintenance and the revenue generated by the scheme. The motorway currently does not generate any revenue directly but does indirectly via a vignette paid by road users for use of Bulgaria’s road network.

Consideration was given to charging road users (tolls) on the Trakia Motorway, with the objective of raising money to contribute to the construction and operating costs of the motorway. These tolls would therefore be set at a revenue-maximising level. However, this was not proceeded with. The principal reason was that the remaining availability payments to the operator were unaffordable, and that there was no tolling elsewhere on the road network (other than bridges over the Danube); tolling would be included on the existing sections of Trakia and this was considered to be politically unacceptable.

The financing of road maintenance and investment is currently being examined on behalf of the Bulgarian authorities by the World Bank. This study will examine a range of options, including distance-based charging for HGVs, and provide the basis for determining future road charging policy. This policy is a key part of the Commission’s 2011 White Paper for Transport. The system would be similar to that operating in the Czech Republic and Poland. The report is due by the end of 2015.
6 Czech Republic: Track modernisation Votice to Benešov u Prahy

6.1 Case study summary

The Votice to Benešov u Prahy project consists of upgrading an 18.4 km section of rail line from single to double track, permitting increased speeds of 160 km/h, and reconstructing existing station infrastructure. The project is located within the Czech Republic, on National Rail Corridor IV, which is being modernised in 10 sections, of which Votice to Benešov u Prahy forms one. Corridor IV provides a key link in the TEN-T railway network; connecting Prague in the north, to České Budějovice and Austria in the south. The project was delivered in four stages and fully completed on 31 May 2013.

The objective of the project is to increase the capacity of the line between Votice and Benešov u Prahy, by implementing a double track configuration which will enable line speeds of 160 km/h and a higher loading capacity for freight. Combined with upgraded signalling, control and communications equipment, as well as reconstructed platforms and station infrastructure, it is anticipated that the rail line will become more attractive to passengers and more competitive as a means of transporting freight.

The rationale for the project is derived from the need to upgrade Corridor IV as a whole. Much of the corridor was single track, with outdated infrastructure which reduced the operational capacity and line speed, leading to increased journey times for passenger and freight trains. Votice to Benešov u Prahy forms one of a total of 10 sections of Corridor IV which have been, or are in the process of being, upgraded by the Railway Infrastructure Administration (SŽDC). Stakeholders viewed the project as being a logical and necessary part of the works to modernise the strategically important Corridor IV to better serve national and international transit, whilst also directly benefitting residents and businesses between Votice and Benešov u Prahy.

The requirement to upgrade Corridor IV is part of a national focus upon modernising the ageing railway network within the Czech Republic; so as to improve national connectivity as well as that with the rest of the EU. Stakeholders noted that the programme of investment in the Czech railways follows on from the modernisation of the rail network in Germany, Austria and Slovakia which border the country.

Stakeholders noted that the project incurred no significant delays during its procurement and construction, and confirmed that it was delivered to the original programme and under budget. The current forecast corridor cost was €317 mn, compared to the 2011 Application Form of €351 mn. The reduction in costs was due to savings made during the procurement of the contact and also the reduced scope of tunnel works.

The 2012 updated Feasibility Study forecast a EBCR of 1.03, compared to the 1.15 originally forecast in 2010. However, it remained the view of stakeholders that the project, and the wider corridor, would represent value for money once the whole corridor works were complete.
6.2 Introduction

Introduction

This report represents the outputs of the case study for Task 3, for the modernisation of the Votice - Benešov u Prahy Railway Line in Czech Republic\textsuperscript{46}. Table 6.1 contains a list of the key stakeholders who were interviewed regarding the project.

Table 6.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Transport</td>
<td>National administration responsible for the preparation of transport policy for the Czech Republic and, where appropriate, its implementation. The evaluation team met with key members of the Ministry who were involved with the project. Its EU Funds Department acts as the managing authority for the operational programme Transport 2007-2013, under which the project discussed here was supported.</td>
</tr>
<tr>
<td>Railway Infrastructure Administration (SŽDC)</td>
<td>SŽDC is the national railway infrastructure manager in the Czech Republic. SŽDC operates the national and regional rail owned by the state, (including its operability, modernisation and development) to the extent necessary for meeting transport needs of the state and transport services. SŽDC is the beneficiary for the project. The evaluation team met with five representatives for SŽDC who, between them, were responsible for all aspects of the project.</td>
</tr>
<tr>
<td>SUDOP PRAHA</td>
<td>Consultants responsible for producing the Feasibility Study and project design, as well as supporting with the preparation of the funding application. The evaluation team met with three individuals from SUDOP PRAHA who were involved with the preparation of the latest (2012) Feasibility Study update.</td>
</tr>
</tbody>
</table>

Source: AECOM/KPMG Evaluation Team

\textsuperscript{46} Votice - Benešov u Prahy Railway Line, 2009CZ161PR013, operational programme Transport, 2007CZ161PO007
Summary of the project

The project involves the modernisation of an 18.4 km section of the Czech National Rail Corridor IV from Votice to Benešov u Prahy (Figure 6.1). The project was delivered with a financial contribution from the Cohesion Fund.

The Czech National Rail Corridor IV is a 226 km long section from Prague to Horní Dvořiště, on the Austrian border. The corridor is part of the TEN-T railway Priority Axis 22 (as defined in the pre-2013 classification) from Prague to Linz (Austria), and as such is a strategic passenger and freight line. Modernisation of the entire corridor began in 2001, and is being undertaken in 10 separate stages (of which this project forms one) with the objective of improving passenger and freight capacity, increasing line speeds and better facilitating cross-border movements. The corridor currently varies from single to double track and experiences speed restrictions due to track condition in certain sections of line.

Figure 6.1 Czech Republic rail corridors

The project consists of upgrading the line from single to double track, reconstructing existing station infrastructure and upgrading signalling, control and communications equipment. Five new tunnels were also created as part of the realignment of certain sections of the existing route (Figure 6.2). The project was delivered in four sections and completed in May 2013.
The Votice to Benešov u Prahy project forms a key part of the modernisation and upgrade of Corridor IV between Prague to Horní Dvořiště, and stakeholders unanimously agreed that it is imperative that all sections are improved to realise the full benefits of the investment in the corridor. Stakeholders considered that the project will contribute towards increased movements of passengers and freight by making the corridor more attractive due to improved journey times and reliability. The project will also enhance the ability of Corridor IV to serve cross-border railway traffic between the Czech Republic and Austria, by providing a continuous, high quality route which is fully interoperable with EU standard rolling stock and technology. In this regard, stakeholders considered the project is important in the context of providing the Czech Republic with the necessary infrastructure to develop economically, and integrate more closely with the European Union.

**Project selection**

The Votice – Benešov u Prahy project was selected because it forms a key part of the overall modernisation of Corridor IV, being undertaken in 10 stages (Figure 6.3). Without upgrading the entire length of the corridor, the benefits of those sections which had been modernised would be reduced. Stakeholders therefore considered the selection of the project within the context of investing in the corridor as a whole. The importance of Corridor IV lies in the fact that it connects Prague in the north to České Budějovice in the south, and further provides cross-border connections to Austria. There are significant commuting and freight movements along the corridor with high passenger demands between Prague and České Budějovice.
6.3 Project context and implementation

Objectives

The project has broad objectives to improve the capacity and speed of the railway line between Votice and Benešov u Prahy, contributing towards a high level of service for the Czech National Rail Corridor IV. Specific objectives for the project include:

- Capacity increase of the existing line through one additional track to establish conditions to satisfy additional transport demand;
- Higher loading capacity as a condition for additional, safe and competitive freight transport demand;
- Travel speed increase through stabilisation and modernisation of the existing line and realignment of certain subsections along the alignment of the new second track;
- Modernisation of the railways operations to allow introduction of up to date technologies and cost saving procedures;
- Provision of adequate comfort and accessibility standards at the passenger railway stations along the line; and

• Contribution to improve the possibilities of cross-border railway traffic between the Czech Republic and Austria according to the European and international agreements.

Policy context
The project forms part of the National Transport Policy of the Czech Republic and is included in the operational programme Transport (OPD) 2007-2013. Stakeholders considered the project to be consistent with the national priority to improve connectivity between Prague in the north and České Budějovice in the south, and as a means of improving connectivity to the rest of Europe via the TEN-T. The Maastricht Treaty\textsuperscript{48} signed by Member States declared the importance of creating trans-European transport networks and this provides the underlying reason for improvements to the Czech National Rail Corridor IV. Stakeholders from the Railway Infrastructure Administration confirmed that the decision to upgrade the national Czech railway network was made shortly after the signing of the treaty in 1993.

At the strategic context, the Votice to Benešove u Prahy project, as part of the development of the Czech National Rail Corridor IV as a whole, is directly aligned with the TEN-T priority project No. 22. Stakeholders cited this as another example of how the project is consistent with Czech national policy to contribute towards the development of the TEN-T. The project (at 18.4 km in length) makes up 8% of the Czech section of the TEN-T railway link from Prague to Linz.

Project implementation
The project Application Form (Section D, page 23) identified a four year construction period (July 2009-December 2013). Stakeholders from the Ministry of Transport and SŽDC confirmed that the project was completed to programme, with no significant delays incurred during any of the project phases.

The tendering period began in mid-2008 and by November 2008 a consortium, Association VoBen, was appointed to deliver the project. Stakeholders from the Ministry of Transport and SŽDC confirmed that the contract was signed in April 2009 and construction on site began in August 2009. SŽDC noted that the project was undertaken with a red FIDIC contract (see footnote 7 on page 17) and that the relationship with the contractor was generally good, with an appropriate level of supervision during the construction phase.

The works were split into four stages: stage one modernised the railway line; stage two reconstructed railway stations along the line and constructed new tracks; stage three modified and launched new stations and lines and removed those that were no longer in operation; and stage four consisted of reclamation work of abandoned sections and carrying out tests and assessments along the route. In June 2013 the design speed of 160 km/h was implemented along the track. According to the Railway Infrastructure Administration, there were 93 change orders (i.e. formal agreements to amend the construction contract by providing an additional fee for additional work incurred by the contractor) during the course of construction, totalling some CZK 10 m (€0.37 mn); however these were considered to be relatively minor changes and did

\textsuperscript{48} Treaty of Maastricht on European Union 1993
not cause any time overruns. An example given by one stakeholder was the reduction in the scope of work required at one station stop, which was identified and subsequently addressed through the change management process.

The corridor was due to be fully upgraded by 2017; however stakeholders confirmed that some of the sections have been delayed considerably, largely as a result of technical challenges experienced during construction, and that the full upgrade of the corridor could be delayed until as late as 2020. It was noted that the section south of Votice – Benešov u Prahy has been delayed from a 2014 completion date to a forecast of 2016. It is understood by the evaluation team that the extended programme for the modernisation works has led to closures of some sections of Corridor IV and frequent delays due to construction works, all of which has, in the opinion of all stakeholders, had a negative impact on the number of passengers using the line. No views were expressed by stakeholders as to the impact these works may have had upon freight, but it can be reasonably assumed that freight volumes would have been reduced as a result of delays or closures along the line.

One stakeholder from the Ministry of Transport noted that there is a bottleneck in the final section of Corridor IV; Horni Dvořiště state boundary - České Budějovice line, as this remains a single track section. A second stakeholder considered that this presents an issue for improving the cross-border connectivity with Austria; a key objective of the Votice – Benešov u Prahy project, and the modernisation of Corridor IV as a whole. It is understood by the evaluator that this has been taken into account in the demand analysis for the project.

Whilst the issues experienced with upgrading other sections of Corridor IV did not affect the Votice – Benešov u Prahy project programme, they nevertheless impacted upon the forecasts for the project, as discussed further in the following sections.
6.4 Demand analysis

Review of assumptions

Table 6.2 presents a summary of the thematic judgement of the demand analysis for the Votice – Benešov u Prahy, derived from Task 2a of this evaluation.

Table 6.2 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
<th>No significant consideration of demographics presented in the published information, although socio economic characteristics are indicated to have been accounted for in the model developed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competing Modes Summary</td>
<td>Scoring</td>
<td>Further details on the underlying assumptions for demand would be beneficial.</td>
</tr>
<tr>
<td>Competing Modes Summary</td>
<td>Scoring</td>
<td>Feasibility Study considers the project in a European and Czech Republic policy context and then undertakes more detailed review of rail network with reference to neighbouring rail routes. VISUM model representing rail and highway modes has been applied.</td>
</tr>
<tr>
<td>Consumer Behaviour Summary</td>
<td>Scoring</td>
<td>Further details on the underlying assumptions for demand would be beneficial.</td>
</tr>
<tr>
<td>Consumer Behaviour Summary</td>
<td>Scoring</td>
<td>PTV VISUM model has been applied to passenger demand. Modest growth estimates applied which are below the forecast national real GDP growth.</td>
</tr>
<tr>
<td>Affordability/Tariffing Summary</td>
<td>Scoring</td>
<td>N/A. Schemes where tariffing is not applicable have been scored amber.</td>
</tr>
</tbody>
</table>


Verification of assumptions

The evaluation team determined that there were two main areas in which the assumptions contained within the project Application Form differed from the post-construction position. First, the demand and economic analyses (as contained within the original Feasibility Study) were undertaken for Corridor IV as a whole, taking into account the modernisation of all 10 stages of the line by 2017.

Demand analysis presented within the Feasibility Study was based on a PTV VISUM model for passenger transport and on a growth forecast for freight traffic. The original Feasibility Study concluded that only a full double-track section between Prague and České Budějovice would provide the necessary journey time and reliability benefits to make the corridor more attractive.
As noted earlier, the full modernisation of Corridor IV has not been completed to programme, and a stakeholder from SUDOP PRAHA confirmed that the current outturn demand was therefore less than that originally forecast in the Feasibility Study. The Feasibility Study was subject to updates in 2005, 2007, 2008 and 2012; the latest iteration of which reflected the fact that the 2017 completion date for works on Corridor IV will not be realised, with a reduction in the forecast growth in passenger numbers and freight flows. It is also understood that the Ministry of Industry and Trade provided corrected economic forecasts in relation to anticipated growth along Corridor IV, which also reflected the changes in the macro-economic conditions within the Czech Republic over this period. SUDOP PRAHA confirmed that these forecasts were included in the 2012 Feasibility Study update.

The second area in which the forecasts within the Application Form were found to be in need of revision related to competing modes of transport. Stakeholders from the Railway Infrastructure Administration noted that the primary competition for the Votice – Benešov u Prahy project is the D3 motorway, which runs north-south parallel to sections of Corridor IV. The original Feasibility Study for the project assumed that the D3 would be completed by 2017. However, stakeholders indicated that works on the highway have encountered significant delays and the full opening of the route is not expected until 2028. Stakeholders from SUDOP PRAHA noted that the forecast traffic flows in the Feasibility Study and interrelationship with any increases or decreases in passenger or freight numbers from the upgraded rail line, needed to be recalculated in the 2012 update.

Stakeholders from the Railway Administration confirmed that the 2012 update of the Feasibility Study was submitted to the European Commission, reflecting the delays to the full modernisation of Corridor IV, as well as to the D3 motorway.

### 6.5 Financial analysis

#### Overview of financial analysis

The project was estimated to cost €344.5 mn in a 2010 version of the Application Form. This was revised to €350.8 mn in a 2011 version of the Application Form. The project was delivered under budget at €317 mn. The Ministry of Transport stated that the saving was realised through the tender process and as a result of the fact that less excavation needed to be carried out in the tunnels and for new routes. The uncertainty regarding project costs, and the change following ground investigations, is considered a systematic bias. The forecast and actual capital costs of the project are provided in Table 6.3.

<table>
<thead>
<tr>
<th>Table 6.3 Cost of Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Forecast Project Cost (2010 Application Form)</td>
</tr>
<tr>
<td>Forecast Project Cost (2011 Application Form)</td>
</tr>
<tr>
<td>Final Project Cost</td>
</tr>
</tbody>
</table>

Source: Final Project Report, Railway Infrastructure Administration (SŽDC)

The Cohesion Fund was expected to contribute €178 mn (51%) to the cost of the project as shown in Table 6.4.
Table 6.4 Contributions to the project

<table>
<thead>
<tr>
<th>Source</th>
<th>€ mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion Fund</td>
<td>178.0</td>
</tr>
<tr>
<td>Czech State</td>
<td>172.8</td>
</tr>
<tr>
<td>Total Budget</td>
<td>350.8</td>
</tr>
</tbody>
</table>

Source: Major Project Application

Economic analysis

The 2012 update of the Feasibility Study recalculated the economic analysis for Corridor IV to reflect the fact that the modernisation works will not be completed by 2017. The revised figures from the Feasibility Study were included within the Final Project report supplied by the Railway Infrastructure Administration, and are presented against those from the original Application Form (Table 6.5). Despite the reduction in scheme costs included within the 2012 Feasibility Study, the EBCR was also forecast to decline, compared with the 2010 Application Form. This is because of a variation for the Nemanice to Ševětín line section (see Figure 6.3), where the track was to remain single.

Table 6.5 Main results of the economic analysis

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic rate of return (%)</td>
<td>6.53</td>
<td>5.71</td>
</tr>
<tr>
<td>Economic net present value (in EUR)</td>
<td>133,431,824</td>
<td>22,963,438</td>
</tr>
<tr>
<td>Economic benefit cost ratio</td>
<td>1.15</td>
<td>1.03</td>
</tr>
</tbody>
</table>

Source: Modernisation of the Votice – Benešov Prahy Cohesion Fund Application Form (2010) and Final Project Report: Railway Infrastructure Administration (SŽDC)

The breakdown of costs and benefits associated with the scheme is shown in Figure 6.4. This shows that 37% of the benefits of the scheme were predicted to be external, such as accidents, noise and pollution. An additional 18% were forecast to come from travel time savings for users.
Financial sustainability

The financial sustainability of the Votice – Benešov u Prahy project is inextricably linked to that of the modernisation of Corridor IV as a whole, as the anticipated benefits of the upgraded rail line, in terms of increased passenger numbers and freight flows, will only be fully realised if the individual projects are all completed. Stakeholders did not refer to the role of track access charges in the context of the financial sustainability of the project. Clearly, there is a risk that the project will not achieve its anticipated outcomes if the full modernisation of Corridor IV is not achieved. However, all stakeholders were confident that, despite the delays experienced, the works would be completed and the full benefits realised (albeit, later that originally intended).

Stakeholders from the Ministry of Transport confirmed that the state provides the maintenance costs for all rail infrastructure and that this would be the case for Corridor IV. It is understood that the funding originates from the state budget and is then allocated to the Railway Infrastructure Administration via the Ministry of Transport. Stakeholders from the Railway Infrastructure Administration confirmed that they prepare a detailed maintenance plan, year on year, to ensure that their infrastructure continues to operate effectively.

Source: Application Form, 2011.
7 Germany: Leipzig City Rail Tunnel (Modules 5 and 6)

7.1 Case study summary
The Leipzig City Rail Tunnel provides an underground link between the two main rail stations and enhanced city-centre access in Leipzig. In total four underground stations are provided along the 5.3 km scheme.

The project was completed in a number of modules. This case study examines modules 5 and 6 which consist of the interior fit-out of the four underground stops and installation of the railway infrastructure and connection to the wider network. Module 5 commenced in October 2007 and was due to complete in June 2012. Module 6 commenced in March 2009 and was due to complete in June 2014. The Leipzig City Rail Tunnel opened in December 2013, six months ahead of the schedule included in the 2009 project application for modules 5 and 6.

The forecast cost of modules 5 and 6 project was €149.3 mn and the current estimate of final cost is in line with this forecast.

There is limited data available on the level of demand for the scheme. Based on the evidence that is available, it appears that the Leipzig City Rail Tunnel is attracting a level of passengers in line with forecasts. The project is therefore expected to provide the net economic benefit forecast, with a EBCR of 1.2.

There is also limited data available to assess the financial sustainability of the project. Nonetheless, the large differential between the forecast additional revenues and operating costs indicates the project is likely to be financially sustainable.

7.2 Introduction
Introduction
This section represents the case study for Task 3, the Leipzig City Rail Tunnel (Modules 5 and 6) project in Germany. A list of the key stakeholders who were interviewed regarding the project is shown in Table 7.1.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal Ministry of Transport and Digital Infrastructure</td>
<td>The Federal Ministry of Transport and Digital Infrastructure is the Managing Authority for the Leipzig City Rail Tunnel (Modules 5 and 6) project. The Ministry is responsible for the federal transport policy and control of funds allocated for transport from the federal budget.</td>
</tr>
<tr>
<td>Deutsche Bahn</td>
<td>Deutsche Bahn (DB) are the Beneficiary of the Leipzig City Rail Tunnel (Modules 5 and 6) project. DB managed the delivery and financing of the project. DB also operates the services that use the Leipzig City Rail Tunnel.</td>
</tr>
</tbody>
</table>

Leipzig City Rail Tunnel (Modules 5 & 6) – 2009DE161PR0009; Transport Infrastructure of the Federal Republic of Germany 2007-2013 operational programme, 2007DE161PO005
In addition, the support of the authorities for the state of Saxony was requested to assist in this case study. However, agreement to carry out interviews could not be reached. It is likely this is due to sensitivities regarding the cost overruns and delays on the other elements of the Leipzig City Rail Tunnel project contained in the 2000 to 2006 operational programme\textsuperscript{51}.

**Summary of the project**

Opened in December 2013, the Leipzig City Rail Tunnel provides direct rail access to Leipzig city centre and a key link between Leipzig’s rail lines. The project was delivered with a financial contribution from the European Regional Development Fund.

Prior to the implementation of the Leipzig City Rail Tunnel, there was no direct rail access to the city centre with rail lines arcing around the downtown area. The two main rail stations in Leipzig (Hauptbahnhof and Bayerischer Bahnhof) are located circa 3 km apart on either side of the downtown area with no direct access between them.

The Leipzig City Rail Tunnel links these two key stations with two additional underground stations in downtown Leipzig, providing direct city centre rail access. In addition, it allows an optimization of rail services in the wider Leipzig area. This is made possible by allowing through-running services to operate in place of services that either terminated at one of the principal stations or travelled around the city centre on existing lines. The route of the Leipzig City Rail Tunnel is shown in Figure 7.1 below.

**Figure 7.1 Leipzig City Rail Tunnel – underground (red) and surface (blue)**\textsuperscript{52}

The full length of the scheme is 5.3 km with the underground section being 4 km. The scheme includes four underground stations shown in Figure 7.2 below:

\textsuperscript{51} German Transport operational programme 2000–2006

\textsuperscript{52} Source: Deutsche Bahn
- Haupbahnhof (Leipzig’s main railway station);
- Markt;
- Wilhelm-Leuschner Platz; and
- Bayerischer Bahnhof.

Semmelweisstrasse is not included in Modules 5 and 6.

**Figure 7.2 Leipzig City Rail Tunnel - stations**

The project implementation was structured in a series of modules. The first four modules (numbers 1, 2, 3 and 4) included the majority of construction works, including the excavation of the tunnels, construction of ramps at tunnel entrances and station structures. These works were completed under the 2000 to 2006 operational programme.

The subject of this study is modules 5 and 6. Module 5 consisted of the interior fit-out of the four underground stops. Module 6 consisted of installing the railway infrastructure and connecting to the network.

Module 7, which was also included in the 2007-2013 operational programme (but not under this project), involved investments in the existing railway infrastructure in the Leipzig area. Figures 7.3 – 7.5 show three of the completed stations.

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53 Source: Deutsche Bahn
54 Transport Infrastructure of the Federal Republic of Germany 2007-2013
Figure 7.3 Leipzig City Rail Tunnel – Hauptbahnhof\textsuperscript{55}

Figure 7.4 Leipzig City Rail Tunnel – Wilhelm-Leuschner-Platz\textsuperscript{56}

\textsuperscript{55} Source: August 2015 Leipzig visit by evaluation team
\textsuperscript{56} Source: August 2015 Leipzig visit by evaluation team
Project selection

The proposal to connect the Hauptbahnhof and Bayerischer Bahnhof stations via Leipzig city centre has been considered for over a century.

In recent times, the need for the Leipzig City Rail Tunnel was established in 1993 in a study carried out by the Free State of Saxony. As a result of this study, the project was included in the state transport plan.

In 1996, the Leipzig City Rail Tunnel was included in national transport planning and in 1998 was included as a target in the Local Transport Plan for the city of Leipzig. The Leipzig City Rail Tunnel was therefore a key transport priority for the city of Leipzig and region of Saxony.

Cohesion Policy transport funds in Germany are generally managed at state level. However, in 2000 - 2006 programming period, agreement was reached that a certain proportion of funds would be allocated to a federal programme, which focused on improving the supra-regional transport infrastructure in the German regions eligible for assistance under Objective 1.

The whole Leipzig City Rail Tunnel project was foreseen for this operational programme. However, due to delays in implementation, the major project was modified to include only modules 1, 2, 3 and 4 for European funding. In the event, the major project City-Tunnel-Leipzig (Module 1-4) has been finalised after the end of programming period in 2009 with the use of Member State resources.

57 Source: August 2015 Leipzig visit by evaluation team
Modules 5 and 6 were developed as a separate project under another transport programme, managed in the 2007-2013 programming period at the national level - operational programme for Transport infrastructure of the Federal Republic of Germany. A revised cost benefit analysis was completed in 2009 and was used as the basis for this project application. This reaffirmed the economic merits of developing the project.

The selection of the Leipzig City Rail Tunnel as a project for development included therefore a prioritisation at both state and federal level.

As state operational programmes had a higher focus on road development, the 2007 - 2013 operational programme for Transport infrastructure of the Federal Republic of Germany was developed with a more equal balance between road and rail projects (47% rail; 46% road; 6% waterways; 1% technical assistance).

Each of the Convergence states that were included in the federal programme prioritised major projects, with the Free State of Saxony proposing the further development of Leipzig City Rail Tunnel as a key priority.

The projects proposed by states were then prioritised at a federal level taking into account the merits of each project, a need for geographic spread and the balance between modes. A formal process evaluating projects based on a number of specific criteria was not employed. As such, the process by which the Leipzig City Rail Tunnel was selected is not fully clear. However, it should be noted that once the project had commenced in the 2000-2006 programming period, the case for including the remaining elements in the 2007-2013 programme period were heightened.

As a result, the Leipzig City Rail Tunnel was included in the 2000-2006 operational programme and subsequently modules 5 and 6 were included in the 2007-2013 operational programme.

7.3 Project context and implementation

Objectives

As outlined in the 2009 project application, the objectives of Leipzig City Rail Tunnel are to:

- Provide direct rail access to Leipzig city centre;
- Increase access to the city centre from new residential and commercial areas in the suburbs of Leipzig;
- Increase the efficiency of the railway infrastructure in Leipzig including a reduction in operating costs;
- Optimization of regional and intercity rail services;
- Increase the sustainability of transport in Leipzig;
- Increase accessibility to Leipzig city;
- Reduce inefficiencies in passenger transport;
• Increase the mode share of public transport; and
• Reduce the level of road usage and associated accidents.

It is noted that these objectives are for the full project, with the subject of this case study being only modules 5 and 6.

Policy context
The Leipzig City Rail Tunnel was supported in federal, state and local transportation policies. The project was included in both the state transport plan for the Free State of Saxony and the local transport plan for the city of Leipzig\(^\text{58}\).

The operational programme for Transport Infrastructure of the Federal Republic of Germany for the 2007-2013 programming period included the Leipzig City Rail Tunnel as a key priority. Priority 1 of this programme involved improving the railway infrastructure of federal railway routes and connections to other modes of transport. The sub-objectives of this priority included: providing railway infrastructure for conurbation traffic, the optimisation of network nodes; the redevelopment of railway infrastructures; and improved transport management and logistics chains. The Leipzig City Rail Tunnel meets these objectives.

Six TEN-T rail lines serve the city of Leipzig. The Leipzig City Rail Tunnel supports the development of these rail lines by allowing regional and long distance services to operate through-running services. These are more efficient than services stopping at the terminal stations of Hauptbahnhof and Bayerischer Bahnhof.

In addition, the Orient/East Med TEN-T transport corridor travels through Leipzig. Although the trains on this route may not use the Leipzig City Rail Tunnel, the impact of the project on rail services in the Leipzig area impacts this corridor positively.

Overall, the Leipzig City Rail Tunnel is supported at policy level from local, state, national and European level.

Project implementation
The implementation of the first four modules of the project was carried out under the 2000-2006 operational programme. These modules constituted the majority of construction works, including the excavation of the tunnels, construction of ramps at tunnel entrances and station structures.

Modules 5 and 6 consisted of the interior fit-out of the four underground stops, installation of the railway infrastructure and connection to the network. Modules 5 and 6 were included in the original project application under the 2000-2006 operational programme along with modules 1 to 4.

The flooding of the river Elbe in 2002 caused significant damage in the Free State of Saxony and surrounding areas. As a result, funds were redistributed away from projects, including the Leipzig City Rail Tunnel. This was the key reason for the delays

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\(^{58}\) See references on p 12 of Project Application (2009DE161PR009)
to the project. The delays were also a key factor in the cost of modules 1 to 4 being much higher than originally forecast – with the increased time adding cost.

Modules 1 to 4 were not included in the 2007-2013 programming period and therefore were not the subject of this case study. The stakeholders agreed to undertake the interviews on this basis. It was not therefore possible to explore the delays and cost overruns in modules 1 to 4 in greater detail.

As a result of the delays in implementing modules 1 to 4, the project application was modified to remove modules 5 and 6. These modules were included as a separate project application under the 2007-2013 operational programme. Funding for modules 5 and 6 of the Leipzig City Rail Tunnel was provided from five sources:

- European Union;
- Germany federal budget;
- Free State of Saxony;
- Leipzig city; and
- Deutsche Bahn.

The funding from all of these sources was managed by a single entity – Deutsche Bahn. This allowed for centralised financial management of the project. Module 5 was project managed by the Free State of Saxony and module 6 was project managed by Deutsche Bahn.

Module 5 (interior fit-out of the four underground stops) was scheduled to commence in October 2007 and complete in June 2012. Module 6 (railway infrastructure and network connection) was scheduled to commence in March 2009 and complete in June 2014.

The contracts used for the Leipzig City Rail Tunnel are part B of the construction contract procedures – known as VOB/B. This construction specific contract type is unique to Germany and dates back to late nineteenth century with the most recent amendments in 2012. VOB/B is used as the standard contract for all Deutsche Bahn construction projects in Germany.

The Leipzig City Rail Tunnel was due to open in June 2014. It opened in December 2013 – six months ahead of schedule. It is considered likely by the evaluators that the programme for modules 5 and 6 included a greater level of contingency given the delays encountered in the modules 1-4. However, this view could not be corroborated by stakeholders.

There were no issues encountered during the implementation of modules 5 and 6 that significantly impacted the overall cost of the project.

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59 DEGES GmbH were appointed project managers on behalf of the state of Saxony; DB ProjektBau GmbH were appointed project managers on behalf of Deutsche Bahn
It is highly likely that the lessons learned from implementing modules 1-4 during the 2000-2006 programming period led to improvements in the methodologies used in the management of modules 5 and 6 in the 2007-2013 programming period. As such, the delivery of modules 5 and 6 as scheduled and on budget would appear to reflect improved quality of project preparations. However, it should also be recognised that the level of risk associated with the works in modules 5 and 6 is lower than that in previous modules.

### 7.4 Demand analysis

**Review of assumptions**

The most recent cost benefit analysis of the Leipzig City Rail Tunnel project was carried out in 2009. Like all previous cost benefit analyses, this was carried out for the entire project.

Although, modules 5 and 6 were developed under a separate project application to the other models of the project, the costs and benefits must be assessed for the entire project. Modules 5 and 6 cannot generate any benefits in the absence of the other modules and vice versa.

Throughout this case study, all cost benefit analysis results are provided based on the full Leipzig City Rail Tunnel project and not just modules 5 and 6.

The principal indicator of the realisation of the benefits associated with the project is the number of passengers who will use services through the Leipzig City Rail Tunnel, and also the number of passengers using other services that are improved as a result of the project. A high level summary of the demand analysis carried out for Leipzig City Rail Tunnel is shown in Table 7.2.

<table>
<thead>
<tr>
<th>Table 7.2 Thematic demand analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics Summary</strong></td>
</tr>
<tr>
<td>The 2009 cost benefit analysis uses socio-economic forecasts produced by the City of Leipzig (2007 to 2027) and Free State of Saxony (up to 2020). In addition, employment data from the Federal Employment Agency was used.</td>
</tr>
<tr>
<td><strong>Competing Modes Summary</strong></td>
</tr>
<tr>
<td>As part of the feasibility studies carried out on the Leipzig City Rail Tunnel, a number of competing modes were examined</td>
</tr>
<tr>
<td>• Unlocking the city centre using trams or buses;</td>
</tr>
<tr>
<td>• Linking a tram system with the existing railway line; and</td>
</tr>
<tr>
<td>• Underground rail link.</td>
</tr>
<tr>
<td><strong>Consumer Behaviour Summary</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
A multi modal transport model was used to inform the demand analysis and economic appraisal. This included 437 traffic areas with forecasts made to 2025. Sensitivities examined included changes in population and development. The methodology applied is considered reasonably robust. It could have been further improved by examining a longer time horizon.

The efficiencies generated in the wider rail network around Leipzig leads to a reduction in operating costs. The income generated by the scheme is additional fare revenues from passengers. These are forecast to be sufficient to cover the net additional operating expenses of the scheme. The affordability analysis could be further improved through the use of sensitivity analysis.

Verification of assumptions

The key output from the Leipzig City Rail Tunnel is the number of passengers carried. The results of the traffic modelling forecast 33,000 passengers a day using the tunnel by 2025. Of this 33,000, 8,000 are additional with the remaining 25,000 being existing passengers. This 8,000 includes 5,000 who transfer from other modes and 3,000 additional trips.

The cost benefit analysis used an annual average employment growth assumption of 9% between 2006 and 2020 (circa 0.6% annual average growth) for the core area of the City of Leipzig. This level of growth is considered conservative given the level of employment growth for Germany as whole is likely to exceed this by 2016. This indicates that there is potential for the Leipzig City Rail Tunnel to exceed the forecasts made.

The services using the Leipzig City Rail Tunnel are generally in keeping with those set in the objectives and included in the cost benefit analysis with the notable exception of intercity services. To date these do not use the Leipzig City Rail Tunnel. The benefits associated with optimisation of intercity services are therefore unlikely, to date, to have been delivered.

In order to provide a quantified measure on the benefits being delivered by the scheme, data on passenger numbers is needed. Ideally data on the numbers using the scheme would be provided by Deutsche Bahn based on ticketing data. Unfortunately, due to reasons of commercial sensitivity, detailed data is not available that allows a direct comparison to be made. Given that Deutsche Bahn (via its subsidiary DB Regio)

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60 Section 3.2, Cost Benefit Analysis – City-Tunnel Leipzig (Spinkermann, 2009)
61 Table 23, Statistical Annex, European Economic Forecast (Winter 2015)
must compete to operate train services, it is understandable that any such data would not be released.

On the one year anniversary of the opening of the Leipzig City Rail Tunnel, a press release was issued providing some details of the operational performance of the project. This press release was issued by Deutsche Bahn in conjunction with ZVNL. ZVNL is the public administrator for transport in Leipzig. The role of ZVNL includes the planning, organisation and financing of regional rail passenger transport.

The press release quantified the number of passengers using the rail network in Leipzig each day at 55,000. However, it did not quantify the numbers using the Leipzig City Rail Tunnel. As the cost benefit analysis developed for the project application only examined traffic using the scheme and not the wider area, it is not possible to carry out a direct comparison.

However, the press release does provide a qualitative analysis of the performance of the project. The Leipzig City Rail Tunnel is found by ZVNL to have become an indispensable element of the transport infrastructure of west Saxony. This is found to be reflected by the high levels of patronage which fully meet the forecasts.

Based on the limited available evidence, it appears that the Leipzig City Rail Tunnel is attracting the levels of passengers that were forecast. It is noted that this assessment is made after only one year of operation and the detailed passenger figures are not available. Nonetheless, this is quite a positive finding.

### 7.5 Financial analysis

#### Overview of financial analysis

The costs associated with the Leipzig City Rail Tunnel include both capital and operating costs. The capital costs for the full project and only modules 5 and 6 are shown in Table 7.3 below, along with the ERDF financial contribution to modules 5 and 6.

<table>
<thead>
<tr>
<th>Description</th>
<th>Forecast 2002</th>
<th>Forecast 2009</th>
<th>Estimated Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full project</td>
<td>571.6</td>
<td>893.3</td>
<td>960.0</td>
</tr>
<tr>
<td>Modules 5 and 6&lt;sup&gt;65&lt;/sup&gt;</td>
<td>177.7</td>
<td>177.7</td>
<td>177.7</td>
</tr>
<tr>
<td>ERDF financial contribution</td>
<td>Not known</td>
<td>77.3</td>
<td>77.3</td>
</tr>
</tbody>
</table>

Source: Project Application and Deutsche Bahn

In 2002, the full Leipzig City Rail Tunnel project (i.e. all modules) was forecast to cost €572 mn. Of this, modules 5 and 6 were forecast to cost €178 mn. In the 2009 project application for modules 5 and 6, the forecast cost for the full project had increased to €893 mn (a 56% increase). Of this, the cost of modules 5 and 6 was forecast to remain at €178 mn.

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<sup>62</sup> [Link](http://www.deutschebahn.com/de/presse/pi_regional/8618934/ssat20141211.html)

<sup>63</sup> Zweckverband für den Nahverkehrsräum Leipzig

<sup>64</sup> Based on text of press release

<sup>65</sup> Note: Cost of module 5 and 6 is €149.3 mn excluding VAT or €177.7 mn including VAT
The latest estimate of the actual cost of the full Leipzig City Rail Tunnel project is €960 mn. This is a 68% increase over the 2002 forecast and a 7.5% increase over the 2009 forecast. Of this total, the estimated cost of modules 5 and 6 remains unchanged from that forecast in 2002 and 2009.

It can therefore be concluded, based on the most recently available data, the full Leipzig City Rail Tunnel project has run substantially over budget. However, modules 5 and 6 have been delivered on budget.

**Economic analysis**

The cost benefit analysis of the Leipzig City Rail Tunnel was evaluated in 2009. The 2009 project application for the Leipzig City Rail Tunnel included modules 5 and 6 only. The cost benefit analysis that accompanied this project application was based on the full project.

The majority of the cost escalation associated with the other modules of the project was included in the cost forecast used in the 2009 cost benefit analysis. However, some additional capital cost increase (7.5%) has subsequently arisen and therefore was not included in the 2009 cost benefit analysis. The results of this study are shown in Table 7.4.

<table>
<thead>
<tr>
<th>Description</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic net present value (€ mn)</td>
<td>117.7</td>
</tr>
<tr>
<td>Economic rate of return</td>
<td>3.9%</td>
</tr>
<tr>
<td>Economic benefit cost ratio</td>
<td>1.22</td>
</tr>
</tbody>
</table>

The breakdown of the costs and benefits are shown in Figure A.25.
The realisation of a positive economic return is based on the actual costs and benefits being in line with the levels forecast. As shown above, the data that is available to date indicates that the passenger levels forecast are being realised. This indicates that the forecast benefits are being realised.

Given the capital cost increase, a corresponding 7.5% increase in benefits would be required in order to achieve the forecast EBCR of 1.2. On the assumption that benefits increase in proportion with passenger numbers using the Leipzig City Rail Tunnel, this would imply a level of 35,500 passengers using the project in 2025.

The level of passenger demand required in 2025 in order to generate a benefit to cost ratio of unity is estimated at 29,000. Once again, this assumes benefits change in proportion to passenger numbers.

Although it is difficult to make any comprehensive conclusion given the limited data available, the indications available imply that the Leipzig City Rail Tunnel is achieving its demand forecasts and therefore is likely to be economically merited. It should be noted that no potential systemic biases have been identified in the analysis and assumptions used in this scheme.

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The negative benefits reported in the Application Form relate to ongoing infrastructure costs, maintenance of vehicles and energy which were reported on the benefits side of the EBCR calculations. This approach of including all cost and benefits other than construction costs on the benefits side of the EBCR calculation is possible, and costs such as maintenance of vehicles are therefore negative.
Financial sustainability

The revenues generated through additional fares as a result of the implementation of the Leipzig City Rail Tunnel are forecast to be significantly higher than the additional operating costs.

This is primarily due to a reduction in operating costs for the rail network in the Leipzig area offsetting a large portion of the operating costs associated with the tunnel section. The forecast net present value of the additional operating costs and revenues are shown in Table 7.5.

Table 7.5 Leipzig City Rail Tunnel – net present value of operating costs and revenues (€ mn ex VAT)

<table>
<thead>
<tr>
<th>Description</th>
<th>Net present value (€ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>135.0</td>
</tr>
<tr>
<td>Operating costs</td>
<td>75.1</td>
</tr>
<tr>
<td>Net income</td>
<td>59.9</td>
</tr>
</tbody>
</table>

Source: Project Application

As previously described, the data that is available indicates that forecast passenger numbers are being realised. This would imply that the additional fare revenues are also being realised. However, confirmation of this is not available.

Similarly, there is no data yet available on operating costs. However, given the large differential between the additional revenues and additional operating costs, it is likely that the project will be financially sustainable unless the actual levels are significantly different from that forecast.
8 Estonia: Reconstruction of Ülemiste Junction in Tallinn

8.1 Case study summary

The Ülemiste Junction project was part of the operational programme “Development of the Economic Environment”, 2007-2013, and is located on the TEN-T. The project consisted of a three level interchange and underground tunnel. The project was designed to accommodate future public transport proposals such as Rail Baltica, a key project on the TEN-T and a new tramlink from the city centre to Tallinn Airport.

For reasons of affordability, the project was split into three stages and this case study concerns only the first of them. Two alternative options were considered for stage one, leading to the identification of the preferred option for which a funding application was submitted to the Commission in 2009. The project opened in October 2013, slightly ahead of programme. Delivery benefitted from the beneficiary’s, Tallinn Municipal Engineering Departments, ability to access additional funds from the Municipality budgets, enabling rapid decisions to be made when issues arose during implementation.

The outturn cost of €74.5 mn was lower than forecast in the 2009 application (€80.8 mn). The primary driver of this was lower than forecast tender prices from contractors, as a result of the global economic recession. Land purchase costs were in excess of 10% of the total construction cost, leading to an element of ineligibility.

Stakeholders believed that the project has been a success in reducing journey times on key movements through the city, including from Tallinn airport to the city centre. Post opening analysis of traffic data indicates that traffic volumes on parallel routes which have been relieved by the project have reduced by 6%, whilst flows on roads improved by the project increased by 6-10%. Stakeholders suggested that traffic growth has been lower in Tallinn than previously forecast, driven by the global economic recession; actual traffic growth has been lower than forecast given Estonia’s actual real GDP growth in the forecast period and the strong traffic growth which was predicted in the period 2005 to 2010.

Stakeholders were not able to make informed comment on the approach adopted on demand forecasting as they were heavily reliant on consultants to undertake these tasks; with JASPERS providing technical assistance to ensure standards are met. The forecast EBCR was 4.2. The JASPERS Completion Note of September 2009 indicated that the cost benefit analysis had a number of assumptions which would have led to the economic appraisal of the project being conservative.

With the strong economic performance of the Ülemiste Junction project in the economic appraisal, the EBCR for the project would still be positive if the economic benefits reduced by 75% and the EBCR would be above 2 if outturn benefits were 50% lower than forecast. Combined with the various conservative assumptions which were adopted in the economic appraisal and the reduction in outturn scheme costs, even with what appear to be lower outturn traffic volumes, the Ülemiste Junction project appears to remain economically justified.
8.2 Introduction

Introduction

This section represents the outputs of the case study for Task 3, for the Ülemiste Junction project in Estonia. Table 8.1 contains a list of the key stakeholders who were interviewed regarding the Ülemiste Junction project. It was not possible to hold and interview with JASPERS as part of this evaluation, due to the specific staff not being available.

Table 8.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Finance</td>
<td>The Ministry of Finance is the Managing Authority for the operational programme for the Development of the Economic Environment and is responsible for Estonia’s national and regional development policy, managing and distributing European Union Structural and Cohesion Fund.</td>
</tr>
<tr>
<td>Ministry of Economic Affairs and Communications (MKM)</td>
<td>The Ministry of Economic Affairs and Communications leads the implementation of the operational programme for the Development of the Economic Environment. The Ministry is responsible for Estonia’s transportation infrastructure, including rail, motorways, expressways and national roads.</td>
</tr>
<tr>
<td>Tallinn Municipal Engineering Services Department</td>
<td>Tallinn Municipality Engineering Services Department is the Beneficiary for the Ülemiste Junction project. They were responsible for the delivery of the project and contributed 25% of the funds required for delivery. They are responsible for the road network in Tallinn and will be responsible for the on-going maintenance of the project.</td>
</tr>
</tbody>
</table>

Source: AECOM/KPMG Evaluation Team

Summary of the project

The project entailed the reconstruction of Ülemiste Junction, into a three-level interchange from a five-leg at-grade road traffic intersection with a railway viaduct which forms the main node of the three TEN-T routes of Estonia (Figure 8.1). The project was delivered with a financial contribution from the Cohesion Fund.

Due to affordability problems, it was decided to split the project into three stages: the first stage involved the construction of a tunnel connecting Peterburi Road and Järvevana Road; the second stage was the construction of Laagna Road connection; and the third stage was the construction of viaducts over the railway.

Figure 8.1 Map of Ülemiste Junction

Only the first stage of construction is covered by the application for Cohesion Policy funding, in the 2007-13 programming period. The first stage was technically and operationally independent from the subsequent stages. The project stage one was completed and opened to traffic in October 2013. Stakeholders have informed the evaluators that stages two and three of the project have been placed on hold.

Stage one consisted of the construction of a new road tunnel connecting Peterburi Road with Järvevana Road under the railway. Overpasses have been built where the extension of Peterburi Road intersects the Tartu highway (Figure 8.2).
The stakeholders who were interviewed as part of this evaluation agreed that the primary function of the scheme, in the context of the junction as a whole, is to remove the bottleneck created at the junction from the strategic north-south and east-west routes. In addition to this, the project would improve the links from Tallinn City to the airport, whilst decreasing journey times and the number of accidents. The completion of the Ülemiste Junction forms a key part of the wider national road network (TEN-T included).

Project selection

Option selection for the Ülemiste Junction was carried out by the Head Committee of Roads for Tallinn City Government authorised by Tallinn City Government Regulation No. 14 of 22 February 2006. Two options were initially proposed:

- Option one: consisting of a three level interchange with an underground roundabout; and
- Option two: consisting of a three level interchange with an underground tunnel.

Although option one generated the higher EBCR of 1.98, compared to option two (1.48), it was decided to proceed with option two as a consequence of the existing terrain and architecture needed. Additionally, the underground roundabout included as part of option one would have caused problematic drainage issues due to the close proximity of Ülemiste Järv lake.

The JASPERS completion note emphasised that whilst the cost benefit analysis for option one was better than the preferred option two, these values could be somewhat distorted on the basis of expropriation/land acquisition prices. In particular, the construction costs for option one may have been underestimated as a result of the more complicated construction techniques involved. Additionally, option two required 20% less land acquisition, reducing one of the delivery risks associated with the project. JASPERS concluded that the selection of option two was fully justified.

Once the option selection was finalised, the chosen option was added to the Tallinn City Development Plan which fed into a national plan, where the schemes were prioritised for future funding. For affordability and delivery reasons it was decided to split the Ülemiste Junction project into three stages.

An updated Feasibility Study was produced in 2009, to support the funding application, which included producing a revised cost benefit appraisal and financial analysis for the preferred option.

68 http://www.tallinn.ee/est/g737s43269. Section 2.2 Economic Development, p. 23
8.3 **Project context and implementation**

**Objectives**
The project had broad objectives to improve the safety and capacity of the road network in and around the Ülemiste Junction. Specific objectives for the project included:

- Reduction of travel time and vehicle operating costs through improved traffic flows, increased travel speed and improved driving conditions; and
- Improvement of traffic safety, through the elimination of one movement from the at-grade intersection.

**Policy context**
The project was identified in a number of different Municipality and National plans/strategies:

- Transport Infrastructure Investment Plan (Republic Government Order No, 126, 6 of March 2008);
- Operational programme “Development of the Economic Environment”;
- Development Plan of Tallinn 2009-2027;
- Tallinn budgetary strategy for period 2009-2012 (Tallinn City Council Decision No. 87, 29 May 2008);
- Tallinn comprehensive plan (Tallinn City Council Regulation No. 3, 11th January 2001); and

All stakeholders interviewed as part of this evaluation referred to the project in terms of the above policy context, and noted the general recognition that the project forms part of the national transport strategy, and contributes towards the wider agenda for transport in Estonia.

The design has incorporated measures to ensure it can accommodate other planned transportation projects. In particular the design included provision for Rail Baltica, a

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69 Source: Ülemiste Junction Project Application - 2009
70 https://www.riigiteataja.ee/akt/13200967. List of Transport Infrastructure Investment Projects
72 https://oigusaktid.tallinn.ee/?id=e_getfile&syscmd=1&lisaid=8998. List of projects.
73 https://oigusaktid.tallinn.ee/?id=savepdf&aktid=111431. Section 4 Overview of aims and activities of the City. p. 35
key TEN-T project, as well as space for a tramway extension to and from the airport. This ensures that no rebuilding of the junction has to take place in the future.

**Project implementation**

The Application Form (Section D, page 25-26) for the project identified a three year construction period (July 2010-October 2013) with it being fully operational by November 2013. The project opened in October 2013 and was therefore completed within the forecast timeframe, improving on the planned operational date by one month. For the purposes of construction, and issues surrounding the level of funding, the project was divided into three stages. Stage one (involving this application) has been completed, with stages two and three placed on hold.

The contracts used for this project were specific to Estonian legislation, and were not standard international contracts such as FIDIC (see footnote 7 on page 17). Tallinn Municipal Engineering Department was the project beneficiary and was responsible for delivery of the project. The beneficiary appointed a consultant to assist with project management and delivery of the project. Due to the scale of investment, Estonian Road’s Agency undertook an oversight role on the project. In addition, Estonian Road’s Agency and the Managing Authority reviewed the beneficiary’s procurement documents prior to launch of the tender process to reduce procurement risks.

During the implementation of the project there were no significant delays. Towards the beginning there was a minor delay which was related to the land ownership; however the delay was caught up over the progress of the project.

Project delivery benefited from Tallinn municipality’s ability to provide additional funding when issues arose, enabling quick decisions to be made on items which may have been ineligible for EC funding. The project also benefited from strong political support in the run up to elections. Stakeholder feedback indicated that there was strong project management during the course of the project’s implementation, with active management of risk issues during bi-weekly project team meetings.
8.4 Demand analysis

Review of assumptions

Table 8.2 presents a summary of the thematic judgement of the demand analysis for the Ülemiste Junction, derived from Task 2a of this evaluation.

<table>
<thead>
<tr>
<th>Table 8.2 Thematic demand analysis</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics Summary</strong></td>
<td></td>
</tr>
<tr>
<td>The population levels have been</td>
<td></td>
</tr>
<tr>
<td>considered for all of the</td>
<td></td>
</tr>
<tr>
<td>municipalities through which the</td>
<td></td>
</tr>
<tr>
<td>route passes. Additionally,</td>
<td></td>
</tr>
<tr>
<td>employees of neighbouring</td>
<td></td>
</tr>
<tr>
<td>municipalities and commuting trips</td>
<td></td>
</tr>
<tr>
<td>are considered. Growth rate</td>
<td></td>
</tr>
<tr>
<td>assumptions take into account</td>
<td></td>
</tr>
<tr>
<td>expected socio-economic</td>
<td></td>
</tr>
<tr>
<td>development in Estonia (population,</td>
<td></td>
</tr>
<tr>
<td>car ownership, mobility, available</td>
<td></td>
</tr>
<tr>
<td>infrastructure), corrected for</td>
<td></td>
</tr>
<tr>
<td>known local developments in land</td>
<td></td>
</tr>
<tr>
<td>use.</td>
<td>G</td>
</tr>
<tr>
<td>Good evidence of the use of a</td>
<td></td>
</tr>
<tr>
<td>variety of key demographic data</td>
<td></td>
</tr>
<tr>
<td>sets to inform the development of</td>
<td></td>
</tr>
<tr>
<td>demand assumptions including</td>
<td></td>
</tr>
<tr>
<td>consideration of future demographic</td>
<td></td>
</tr>
<tr>
<td>trends</td>
<td></td>
</tr>
<tr>
<td><strong>Competing Modes Summary</strong></td>
<td></td>
</tr>
<tr>
<td>The Feasibility Study looked at</td>
<td></td>
</tr>
<tr>
<td>two junction improvement options,</td>
<td></td>
</tr>
<tr>
<td>no other modes were considered.</td>
<td></td>
</tr>
<tr>
<td>A simple statistical approach to</td>
<td></td>
</tr>
<tr>
<td>demand analysis was applied.</td>
<td>R</td>
</tr>
<tr>
<td>No evidence that the approach</td>
<td></td>
</tr>
<tr>
<td>taken to demand analysis allows</td>
<td></td>
</tr>
<tr>
<td>forecasting of the project impact</td>
<td></td>
</tr>
<tr>
<td>on other transport corridors or</td>
<td></td>
</tr>
<tr>
<td>transport modes.</td>
<td></td>
</tr>
<tr>
<td><strong>Consumer Behaviour Summary</strong></td>
<td></td>
</tr>
<tr>
<td>Simple statistical approach to</td>
<td></td>
</tr>
<tr>
<td>demand analysis using a CUBE model</td>
<td></td>
</tr>
<tr>
<td>but no origin/destination data for</td>
<td></td>
</tr>
<tr>
<td>forecasting.</td>
<td>A</td>
</tr>
<tr>
<td>The methodology applied included</td>
<td></td>
</tr>
<tr>
<td>the project’s impact on consumer</td>
<td></td>
</tr>
<tr>
<td>behaviour.</td>
<td></td>
</tr>
<tr>
<td><strong>Affordability/Tariffing Summary</strong></td>
<td></td>
</tr>
<tr>
<td>No tolling element to this scheme,</td>
<td></td>
</tr>
<tr>
<td>hence no consideration of tariffing</td>
<td></td>
</tr>
<tr>
<td>or affordability issues.</td>
<td>A</td>
</tr>
<tr>
<td>Some consideration of an appropriate tariffing arrangement, possibly making use of existing tariffing arrangements. Schemes where tariffing is not applicable have been scored amber.</td>
<td></td>
</tr>
</tbody>
</table>


Verification of assumptions

The stakeholder interviews conducted in July 2015 provided the opportunity to identify and discuss the assumptions and wider observations from the project, which they felt would be of interest to the Commission.

The demand analysis (traffic forecasts) was undertaken by Stratum who holds the model of Tallinn City with future and existing traffic forecasts. Traffic demand forecasting was not an area of expertise of the stakeholders, with this work undertaken by consultants on their behalf. JASPERS provided support in this area on the Ülemiste Junction project.
The traffic forecasts were based on extensive traffic surveys, and included six vehicle classes. Factors including population growth, car ownership and committed land use development were also included within the forecasting. The JASPERS completion note stated that ‘the traffic projections, in the absence of origin-destination surveys, are certainly robust in this specific context of an expanding capital city and region, concentrating the vast majority of the national population, with perspectives of very strong growth of real GDP and revenue per inhabitant’.

The strategic nature of the Ülemiste Junction, particularly the function it plays in being the intersection of the Tallin-Narva (the Peterburi Road section runs through the junction) and Tartu highways, meant it was forecast to carry commuter and regional/national/international traffic. Between 2000 and 2005, the average annual traffic growth rate had been between 2.7% (on the Tartu highway) and 5.6% (on Veerenni Street). The forecast average annual growth rate between 2005 and 2027 was circa 2.6% (on Peterburi Road), therefore at the lower end of historic observed growth rates.

The beneficiary commissioned a study in 2013 to undertake a review of traffic flows pre and post opening of the project. The analysis included a sample of traffic counts at key locations immediately prior to the scheme opening and one month after scheme opening. A review of available automatic traffic count data from Tallinn’s traffic monitoring system was also undertaken. The study did not investigate other metrics such as changes in journey times and did not compare outturn traffic volumes with the forecasts produced as part of the Feasibility Study.

The conclusion drawn from the post opening study was that traffic volumes on the corridor served by the project increased by approximately 6%-10%, whilst roads within the city which run parallel to the project corridor have experienced a 6% reduction in traffic volumes, which stakeholders indicated was a key success of the project.

Figure 8.3 has been derived from data contained in the 2013 traffic analysis and shows morning peak period traffic flow data obtained on 09/25/2013 (pre-opening) and 11/14/2013 (post opening). The data shows a 157% increase in traffic flows on Peterburi Road, the key east–west route which the project has improved connectivity to, whilst there has been reductions on the roads which run parallel to the project corridor. The analysis indicates an 8% increase in flows across the cordon of traffic count locations. However, it should be noted that the sample of traffic counts does not cover all locations on the cordon, in particular there is another key east–west road further north of Laagna Road, which may also have reduced traffic flows following the opening of the project.

74 Stratum, Ülemiste traffic Open Impact Analysis, 2013
As part of this evaluation, we have compared the post opening traffic volumes with the forecasts which are provided in the Feasibility Study. Given the available information, it has been difficult to confirm that the counts being compared are in identical locations and therefore the below comments need to be treated with some caution. However, the review highlights the following key issues.

**Lower than forecast traffic growth**

Stakeholders indicated that traffic growth in Tallinn had been lower than forecast, driven by the global economic recession. The post opening impact report indicates that overall traffic across all monitoring points in Tallinn, reduced by 0.3% between 2012 and 2013. Table 8.2 shows the forecast traffic growth rates in the project feasibility study for the Reference Case at a number of locations critical to the project. Higher growth rates were forecast in the short term, 2005-2010, with lower growth assumed in the longer term from 2010 to 2027.

### Table 8.2 Traffic Growth Forecasts Feasibility Study

<table>
<thead>
<tr>
<th>Road</th>
<th>2005-2010 Per annum</th>
<th>2010-2027 Per annum</th>
<th>2005-2027 Per annum</th>
<th>2005-2013 Total Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Järvevana Rd</td>
<td>3.1%</td>
<td>1.5%</td>
<td>1.8%</td>
<td>21.8%</td>
</tr>
<tr>
<td>Peterburi Rd</td>
<td>6.0%</td>
<td>1.7%</td>
<td>2.6%</td>
<td>40.4%</td>
</tr>
<tr>
<td>Laagna Rd</td>
<td>3.8%</td>
<td>1.7%</td>
<td>2.2%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Endla St</td>
<td>1.3%</td>
<td>1.1%</td>
<td>1.2%</td>
<td>10.2%</td>
</tr>
</tbody>
</table>

Table 8.3 shows output real GDP growth for Estonia in the period 2005 to 2013. The global economic crisis resulted in a sharp decline in GDP in 2008 and 2009, with real GDP in Estonia reducing by 1.4% between 2005 (base year for traffic model) and
2010. In the period from 2010 to scheme opening in 2013, GDP had grown at 4.8% per annum, resulting in overall GDP growth between 2005 and 2013 of 13.6%, 1.6% per annum.

**Table 8.3 Real GDP Growth Estonia**

<table>
<thead>
<tr>
<th>Road</th>
<th>2005-2010</th>
<th>2010-2013</th>
<th>2005-2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real GDP Growth</td>
<td>-1.4%</td>
<td>15.2%</td>
<td>13.6%</td>
</tr>
<tr>
<td>Real GDP Growth per annum</td>
<td>-0.3%</td>
<td>4.8%</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Whilst GDP growth does not appear to have been used directly as an input to the traffic forecasting approach, it is implicitly included in the trend analysis which has been adopted to forecast changes in car ownership, average distance travelled and the land use development assumptions. In light of the slower than forecast actual GDP trend, we may expect traffic to grow slower than was expected.

**Traffic models poor forecasting of traffic reassignment impacts**

It has been difficult to directly compare forecast traffic volumes with the outturn data due to uncertainty about locations of traffic data and the lack of directly comparable data. Figure 8.3 does provide percentage change in traffic volumes during a one day morning peak period pre and post opening of the project in 2013. Noting the small sample size for the outturn data, Table 8.4 provides a comparison of the forecast percentage change in traffic flows at three locations where the data is understood to be comparable. This suggests that the traffic model used to inform the Feasibility Study has poorly forecast the traffic reassignment impact, in particular the increase in flow which would occur on Peterburi Road the key road which is improved as part of the project.

**Table 8.4 Traffic growth forecasts feasibility study**

<table>
<thead>
<tr>
<th>Road</th>
<th>Forecast % change Flow 78</th>
<th>Outturn % change in Flow 79</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peturburi Rd</td>
<td>+6.5%</td>
<td>+157%</td>
</tr>
<tr>
<td>Laagna Rd</td>
<td>-19.6%</td>
<td>-16%</td>
</tr>
<tr>
<td>Sõjamäe</td>
<td>-2.3%</td>
<td>-16%</td>
</tr>
</tbody>
</table>

The JASPERS completion note (September 2009) made a recommendation that in the future more emphasis should be placed on the demand forecasting for projects, in particular the use of origin and destination surveys to support the statistical base. Stakeholders appeared unaware of this recommendation and were unable to comment.

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75 Source: Eurostat Real GDP Growth Code tec00115, Last update 18.08.2015
76 It has not been possible to compare change in actual flows as comparable data is not available. i.e. one data set is peak period, the other data set is AADT.
77 It is possible that traffic volumes on Peterburi Rd reduced during the construction period and that the comparison is for this reason not valid.
78 AECOM’s calculation from Section 6, Stratum, Ülemiste traffic Open Impact Analysis, 2013
79 AECOM’s calculation from Table I.6.3 Ülemiste Junction Feasibility Study and Cost-Benefit Analysis
on whether this recommendation has been acted upon, aside from reaffirming the role which JASPERS continue to play in providing technical assistance in this area.

8.5 Financial analysis

Overview of financial analysis

The project was estimated to cost €80.8 mn\textsuperscript{80} in the 2009 project application which was approved by the European Commission. Approximately €0.9 mn of land purchase costs were ineligible as the total estimated land purchase costs exceeded 10% of the total construction cost, excluding VAT. Table 8.5 shows the cost estimates for the project.

Table 8.5 Cost of and contribution to Ülemiste Junction

<table>
<thead>
<tr>
<th>Cost Estimate Produced</th>
<th>Cost (€ mn)</th>
<th>Eligible Cost (€ mn)</th>
<th>EU Contribution (€ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application – 2009 (assumed 2009 prices)</td>
<td>80.8</td>
<td>79.9</td>
<td>67.9</td>
</tr>
<tr>
<td>Outturn Cost (2013 prices)</td>
<td>74.5</td>
<td>68.6</td>
<td>58.3</td>
</tr>
</tbody>
</table>

The outturn eligible cost of the project was €68.6 mn\textsuperscript{81}, with the total cost of the project €74.5 mn\textsuperscript{82} including ineligible costs. Stakeholders indicated that contractor prices were lower than estimated as a result of the timing of the economic crisis.

Outturn land purchase costs were €8.1 mn, but only 10% of the total outturn construction costs were eligible (€6.9 mn). Additional ineligible outturn costs related to project management and some construction works. Tallinn municipality was able to cover these additional costs from their own internal resources.

The project was financed through the Cohesion Fund and Tallinn municipality funded the national contribution for the project; they will also be responsible for future maintenance of the project.

Economic analysis

The breakdown of forecast benefits associated with the scheme is shown in Figure 8.4. This shows that the vast majority (nearly 80%) of forecast benefits of the scheme were travel time savings across Tallinn, through the enhanced connectivity and reduced waiting times at the junction.

\textsuperscript{80} Source: Ülemiste Junction Project Application - 2009
\textsuperscript{81} Source: Ministry of Economic Affairs and Communications Stakeholder feedback
\textsuperscript{82} Source: Tallinn Municipal Engineering Services Department Stakeholder feedback
Figure 8.4 Breakdown of forecast economic benefits and costs\textsuperscript{83}

The JASPERS completion note concluded that the economic analysis was undertaken in line with EU requirements. However, they identified a number of conservative assumptions (examples of systematic bias in Estonia) which had been adopted in the economic appraisal, including:

- Use of low values of time, compared with HEATCO values for Estonia\textsuperscript{84};
- Impact of real GDP growth on the value of time and accident costs not included;
- Demand forecasting approach was limited to peak hours only, leading to journey time savings not covering full 24 hours of day. Noting, peak hours will be when main benefits are provided by project; and
- Environmental benefits (savings in emissions) were not included.

In overall economic terms, the Application Form (page 32) forecast a EBCR of 4.2, with economic rate of return of 22.9%.

\textsuperscript{83} Source: 2009 Application Form

\textsuperscript{84} Source: JASPERS completion note. Average unit value of time used in the economic appraisal is 3.43 EUR per hour, whereas HEATCO values for Estonia are 12.82 EUR for work travel time and 4.99 EUR for commuting (2002 base year). HEATCO was commonly used as a source for value of time for cost benefit appraisal. 2014 -2020 EU CBA Guidance is now recommending that value of time is either calculated locally by using Revealed Preference Method, or estimated using the Cost Saving Approach. P. 70.
The previous section highlighted that outturn traffic appears to have grown at a slower rate than forecast, driven by the impacts of the global economic crisis, suggesting that the economic benefits for the project have been overstated.

With the strong economic performance of the Ülemiste Junction project in the economic appraisal, the EBCR for the project would still be positive if the economic benefits reduced by 75% against forecast and the EBCR would be above 2 if outturn benefits were 50% lower than forecast. Combined with the various conservative assumptions which were adopted in the economic appraisal and the reduction in outturn scheme costs, even with what appear to be lower outturn traffic volumes, the Ülemiste Junction project appears to remain economically justified.

All stakeholders stated that journey times and particularly journey time reliability between the City and airport have improved, with the project seen as being successful.

**Financial sustainability**

Maintenance costs are included in the economic financial analyses for the project. There are no tolls proposed for the roads that pass through the junction, and so the project is non-revenue generating. Tallinn municipality will be responsible for future maintenance of the project.
9 Spain: Madrid-Valencia-Murcia High Speed Rail

9.1 Case study summary

This €1,454 mn high speed rail project consisted of two phases: phase 1 linking Madrid to Albacete; and phase 2 completing the links to Alicante and Murcia. In total, approximately 220 km of new high speed rail (double track) was implemented between 2009 and 2013.

Phase 1 of the project was implemented in line with the duration defined in the Application Form, although the period of construction commenced later than planned, with the route opening in December 2011. Phase 2 of the project was opened in December 2013. There were no significant delays in implementation identified by stakeholders. It is also noteworthy that the purchase of land required for the project commenced in 2005, well in advance of the actual construction period.

The project was delivered within the forecast cost presented in the Application Form. The beneficiary attributed this success to the cumulative experience in the provision of high speed rail infrastructure, and the political consensus that this was a priority project. The economic downturn also contributed to lowering contractor costs according to stakeholders.

At this stage patronage is approximately half the level forecast at the time of the funding application. This is due to a general decline in travel demand in Spain as a result of the serious economic crisis, the fact that fares were higher than forecast until 2015 and that service frequencies have not yet reached their planned levels due to low demand; 28 services per day are operating compared to the proposed 53.

The EBCR for the project (combining phases 1 and 2) was 1.04, so showing only marginal benefits. However, the project is having its intended impact of attracting travellers to rail from air and road transport. When total transport demand returns to normal levels with the recovery of the Spanish economy it will deliver the expected levels of benefit.
9.2 Introduction

Introduction

This section documents the Madrid-Valencia-Murcia High Speed Rail project. Table 9.1 contains a list of the key stakeholders who were interviewed regarding the project.

Table 9.1 Stakeholders interviewed

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADIF (Administrator of Railway Infrastructure)</td>
<td>Beneficiary, responsible for planning, managing and delivering the project.</td>
</tr>
<tr>
<td>Ministry of Finance and Public Administration</td>
<td>Managing Authority, responsible for establishing the overarching investment strategy within the OP. Its responsibilities include European territorial cooperation and urban development, programming and evaluation of European funding, economic planning, rail planning, and infrastructure and transport planning.</td>
</tr>
</tbody>
</table>

Summary of the project

The Madrid-Valencia-Murcia project is part of a programme of developing a wide network of high speed rail across the Iberian Peninsula. Figure 9.1 shows the completed and future high speed rail lines in Spain and Portugal at the time the project application was made in 2009. The project was delivered with a financial contribution from the Cohesion Fund.

The Madrid-Valencia-Murcia project is an element of the south-eastern section of the network, connecting Madrid to Valencia and Alicante/Murcia.

This section of the high speed rail network was planned to be delivered in phases. The first phase included new high speed tracks from south of Madrid to Albacete and Valencia. Trains to Alicante and Murcia would operate as high speed trains as far as Alicante, before transferring to existing track to complete their journey. The second phase of the project will complete the high speed network between Albacete, Alicante, Murcia and Xàtvia.

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The Madrid-Valencia-Murcia project examined in this case study includes the construction of the majority of the high speed rail line between Madrid and Valencia along with some works on the southern branch to Albacete/Alicante. In all cases this requires the construction of new line rather than the upgrading of existing line.

Other sections of the project were already completed (Figure A.30) or were to be completed under separate projects. The Madrid-Valencia-Murcia project includes the following sections:

- Torrejón De Velasco – Fuentes: 179.07 km;
- Raf Valencia: 1.71 km;
- Accesos a Albacete 7.26 km;
- Caudete – Sax 22.57 km;
- La Alcoraya – Alicante 10.00 km; and

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86 Madrid-Valencia-Murcia High Speed Rail (Phase 1) project application
The total length of all sections is 220.6 km. The project forms part of the TEN-T. The route from Madrid to Valencia and the route from Valencia to Murcia form part of the core passenger rail network, and the branch section via Albacete to Alicante forms part of the comprehensive passenger network.\textsuperscript{87}

**Project selection**

In December 1999, the Ministry of Infrastructure and Transport published a Feasibility Study of the potential for a high speed rail line connecting Madrid with Valencia, and subsequently Murcia. Based on feedback received as part of a public consultation, changes were made to reduce the impact on the environment and future railway operations. A supplementary report was published in September 2000 which, once again, was subject to public consultation.

According to ADIF, the strategic decision to build a comprehensive high speed rail network, and to include the Madrid-Valencia-Alicante corridor in this network pre-dated the establishment of ADIF so they were not able to comment on this aspect of project selection. The Ministry of Infrastructure and Transport indicated that the high speed rail network was a longstanding national priority. The network, and this specific project were included in the relevant national strategy for the programming period, “PEIT Strategic Infrastructures and Transport Plan 2005-2020”. In fact, completion of the high speed rail network has long been a priority for all stakeholders in Spain. The Ministry indicated that the high level of bi-partisan political support for completion of the network was a key factor behind successful and timely completion of individual projects.

In January 2001, the Minister of Public Works and presidents of Madrid, Valencia, Castilla-La Mancha and Murcia agreed this route.

**9.3 Project context and implementation**

**Objectives**

As detailed in the project Application Form, the key objective of the project was to reduce the travel time between Madrid and the provinces of Castilla-La Mancha, Valencia and Murcia. The main project benefits identified in the project application are:

- Reduced journey times;
- Increased capacity, frequency and regularity (as a result of double tracking for the full length of the line);
- Increased passenger comfort;
- Increased public transport modal share along the corridor; and
- Increased safety and security through the absence of level crossings and provision of security fencing on both sides of the rail line.

\textsuperscript{87} As defined in Regulation (UE) No 1315/2013
**Policy context**

The European White Paper on Transport published in 2001 included high speed rail among the priorities for development of multimodal transport corridors. The modernization of the rail network and improving long distance passenger journeys were also among its key objectives.

The project contributes to developing interoperability of high speed rail in the Iberian Peninsula and is in accordance with the objectives established for priority axis 19 of the TEN-T. The project also allows interconnection with the TEN-T through the Mediterranean Corridor.

At a Member State level the project was part of a long standing strategic objective to complete a national high speed rail network. The importance, in economic terms, of the Mediterranean and, more specifically, Valencia and Murcia was also central to the prioritisation of the project. With 29% of the Spanish population living in the region (Madrid, Albacete, Cuenca, Valencia and Murcia) the project will support improvements in the inter-relationship of these areas with the rest of Spain. The strategic nature of the project was therefore important, providing connectivity and cohesion to/for central and eastern Spain, complementing conventional rail services.

**Project implementation**

This project was completed within the 2007-2013 programming period. Due to the length of the line the project was split into two phases: phase 1 between Madrid and Albacete; and phase 2 linking to Murcia and Alicante.

The Application Form identified that land purchasing commenced in March 2005, well ahead of the construction of the project. However, stakeholders were not able to confirm the actual programme or elaborate on the benefits of this approach.

The high speed links between Madrid and Valencia, and Madrid and Albacete were completed in December 2011. The forecast construction period of three years was adhered to according to stakeholders, although the evaluators were not able to verify such statements. The high speed link between Madrid and Alicante was completed by December 2013. The network currently in place is shown in Figure 9.2.

The outturn cost was not materially above the budgeted amount. In discussions, stakeholders from the beneficiary indicated that this was partly due to construction costs in Spain being depressed during the construction period by the ongoing economic crisis.

The efficient implementation of the project in terms of cost and programme was attributed to the extensive experience of ADIF and contractors in the construction of high speed rail and the high degree of political consensus that the project was a national strategic priority. Changes in government and in economic circumstances did not change the high priority given to this project.
Figure 9.2  Completed High Speed Rail on Madrid-Valencia-Murcia Corridor

Source: ADIF Alta Velocidad
9.4 Demand analysis

Review of assumptions

Table 9.2 presents a summary of the thematic judgement of the demand analysis for the Madrid-Valencia-Murcia Phase 1 project.

Table 9.2 Thematic demand analysis

<table>
<thead>
<tr>
<th>Demographics Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited information provided. The populations have been considered as a beneficiary. Meanwhile employment has been considered in the financial analysis.</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Although there is an options considered section, it appears the project has not considered any alternatives. Train, car, bus and air options were considered within the analysis.</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumer Behaviour Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decreasing travel times while increase capacity and frequency are key objectives of the project.</td>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Affordability/Tariffing Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The revenues projected from the line include access fees, capacity reservation charges, circulation charges, traffic charges and station use charges. These revenues are forecast to cover the operation and maintenance cost of the line.</td>
<td>A</td>
</tr>
</tbody>
</table>


Verification of assumptions

In the event the levels of patronage on the Madrid-Valencia-Murcia corridor is significantly lower than was forecast when the application for funding was made. The patronage forecasts in the Application Form came from transport modelling carried out in 2007. Table 9.3 compares the levels of patronage that were originally forecast for 2013, and actual levels observed in 2014 through surveys and modelling conducted by ADIF.

Overall, actual rail traffic on the corridor for 2014 is 51% below the levels that were forecast for 2013 at the time that the application for funding was made. From the point of view of evaluating this project a number of related questions arise:

- Can the difference be explained by outside factors that were not known at the time the original forecasts were prepared;
• What does this outturn tell us about the quality of demand forecasting carried out by the Spanish authorities in the development stages of this project;

• Is the project having the type of impact that was intended; and

• Given what is now known is it probable that the project will realise the benefits that were anticipated when it was under development.

Table 9.3 Forecast and actual demand (annual rail trips)

<table>
<thead>
<tr>
<th>('000 Passengers)</th>
<th>2013 Forecast</th>
<th>2014 Actual</th>
<th>Variance %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Long Distance</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madrid-Valencia</td>
<td>3,378</td>
<td>1,736</td>
<td>-49%</td>
</tr>
<tr>
<td>Madrid-Alicante</td>
<td>2,256</td>
<td>1,204</td>
<td>-47%</td>
</tr>
<tr>
<td>Madrid-Murcia</td>
<td>493</td>
<td>386</td>
<td>-22%</td>
</tr>
<tr>
<td>Madrid-Castellón</td>
<td>248</td>
<td>98</td>
<td>-60%</td>
</tr>
<tr>
<td><strong>Total Long Distance</strong></td>
<td>6,375</td>
<td>3,424</td>
<td>-46%</td>
</tr>
<tr>
<td><strong>Regional</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Madrid-Albacete</td>
<td>756</td>
<td>322</td>
<td>-57%</td>
</tr>
<tr>
<td>Madrid-Cuenca</td>
<td>637</td>
<td>162</td>
<td>-75%</td>
</tr>
<tr>
<td>Valencia-Albacete</td>
<td>354</td>
<td>149</td>
<td>-58%</td>
</tr>
<tr>
<td>Valencia-Cuenca</td>
<td>310</td>
<td>94</td>
<td>-70%</td>
</tr>
<tr>
<td>Alicante-Albacete</td>
<td>378</td>
<td>147</td>
<td>-61%</td>
</tr>
<tr>
<td>Alicante-Cuenca</td>
<td>73</td>
<td>19</td>
<td>-74%</td>
</tr>
<tr>
<td>Murcia-Albacete</td>
<td>29</td>
<td>17</td>
<td>-41%</td>
</tr>
<tr>
<td>Murcia-Cuenca</td>
<td>76</td>
<td>2</td>
<td>-97%</td>
</tr>
<tr>
<td>Castellón-Albacete</td>
<td>7</td>
<td>3</td>
<td>-57%</td>
</tr>
<tr>
<td>Castellón-Cuenca</td>
<td>8</td>
<td>2</td>
<td>-75%</td>
</tr>
<tr>
<td>Albacete-Cuenca</td>
<td>34</td>
<td>58</td>
<td>71%</td>
</tr>
<tr>
<td><strong>Total Regional</strong></td>
<td>2,662</td>
<td>975</td>
<td>-63%</td>
</tr>
<tr>
<td><strong>Total Rail</strong></td>
<td>9,037</td>
<td>4,399</td>
<td>-51%</td>
</tr>
</tbody>
</table>
A number of factors were different in reality compared to the assumptions made in 2007. All of these would have had the effect of making actual traffic lower than was forecast in 2007. These factors were:

- The growth in the Spanish economy;
- The frequency of rail services offered on the new infrastructure; and
- The fares for these rail services.

In 2007, forecasters expected the Spanish economy to enter a recession. The forecast was based on an assumption that Spanish real GDP would shrink by between 0.5% and 1% in real terms in 2008 and 2009 before returning to growth of 2% per annum in 2010. Growth was forecast to return to a long term trend growth rate of 4% per annum by 2012. These short term forecasts were based on the official forecasts of the Spanish government at the time. In fact the economic crisis in Spain was much more severe than expected in 2007. Spanish real GDP actually shrank by 4% in 2009, and shrank by a further 2% in 2012 and 2013. Figure 9.3 compares the 2007 forecasts of real GDP growth with the actual outturn up to 2014.

![Figure 9.3 Impact of economic crisis](image)

The economic crisis significantly reduced all forms of travel in Spain. Between 2006 and 2013 total travel on toll roads declined by 33%. Over the same period air travel declined by 30%.

Between 2008 and 2013 high speed rail fares were 17% higher than had been assumed in the 2007 study. In early 2013 high speed rail fares were decreased by 15% and are now at the levels assumed in the original forecast.

The forecasts prepared in 2007 assumed that a total of 53 high speed services a day would be offered on this corridor by 2013. In the event the rollout of services was slower than anticipated, mainly in response to lower demand for all transport services.

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88 Source: Ministerio de Fomento
In fact only 28 services a day are offered on the corridor. This will have had the effect of further dampening demand.

It is clear that the difference between actual and forecast use of this high speed rail corridor can be explained by factors which were not known at the time that the forecast was prepared. Further, these factors were not foreseeable at the time that the forecast was prepared.

The beneficiary has carried out transport surveys to measure the impact of the new high speed rail services on travel in the corridor between Madrid and Valencia/Alicante. This work had covered travel by all modes on this transport corridor. This work provides encouraging evidence that, although total travel is currently reduced by the economic crisis, the new high speed rail services are having the intended effect on the remaining travellers, as the comparison of forecast and actual mode shares demonstrate (Figure 9.4).

Figure 9.4 Forecast and outturn mode share

The introduction of high speed rail services between Madrid and Valencia led to a sharp decline in air travel in 2012, with these passengers being captured by the new rail services (See Figures 9.5 and 9.6).
**Figure 9.5 Impact of Madrid-Valencia air services**

Source: ADIF Alta Velocidad

**Figure 9.6 Impact of Madrid-Alicante air services**

Source: ADIF Alta Velocidad
9.5 Financial analysis

Overview of financial analysis

The forecast project cost as set out in the Application Form was €1,454 mn as shown in Table 9.4. The project was to be delivered with a €725 mn contribution from Cohesion Policy funding.

Table 9.4 Cost of and contribution to Madrid-Valencia-Murcia high speed rail

<table>
<thead>
<tr>
<th>Cost Estimate Produced</th>
<th>Cost (€ mn)</th>
<th>Eligible Cost (€ mn)</th>
<th>EU Contribution (€ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application – 2009 (assumed 2009 prices)</td>
<td>1,454</td>
<td>1,122</td>
<td>725</td>
</tr>
</tbody>
</table>

Economic analysis

The economic analysis of a major project includes three key elements: namely the capital cost; operation and maintenance cost; and revenues. According to the cost benefit analysis presented as part of the application for funding, the project was expected to have a net present value (NPV) of €612 mn and a EBCR of 1.04. A breakdown of the forecast economic costs and benefits are shown in Figure 9.7. It should be noted that the analysis was for the combined project, including both phases.
The outturn costs are not materially different from those forecast. Current levels of patronage are significantly below those forecast. However, as discussed above, this is due to a general temporary decline in travel as a result of the economic crisis, the fact that services have not reached the planned level of frequency yet and the fact that fares were higher than forecast until recently. The project is succeeding in winning market share for rail at the expense of air and road transport as planned. Provided that it reaches full capacity in terms of frequency and that general levels of travel in Spain return to normal it should reach expected levels of patronage and deliver the planned level of benefits.

**Financial sustainability**

The project was built by ADIF and is operated and maintained by the same entity. The capital cost of building the project was met from government subvention to ADIF. The ongoing maintenance and operation costs are financed from track access charges paid by RENFE the national train operator to ADIF.
10 Hungary: Budapest Metro Line 4

10.1 Introduction

The Directorate General for Regional and Urban Policy of the European Commission (DG REGIO) is currently undertaking an ex-post evaluation of Cohesion Policy programmes between 2007 and 2013. As part of this work DG REGIO has commissioned a study referred to as “Work Package 5: Transport” from AECOM and KPMG. Task 3 of the evaluation involves preparing case studies for 10 major projects with the following objectives as defined in the Terms of Reference (ToR):

- To verify the correctness of assumptions underlying demand and financial analyses; and
- To understand the context in which projects are implemented.

This report represents the pilot case study for Task 3, the Budapest Metro Line 4 project in Hungary. Table 10.1 sets out the structure of this report and indicates where the Commission’s requirements, as defined within the ToR, are addressed in relation to the Budapest Metro Line 4 project.

Table 10.1 – Report structure

<table>
<thead>
<tr>
<th>Report Section</th>
<th>ToR Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction</td>
<td>• Provide an overview of the selection mechanism and the factors that led to the selection of the project.</td>
</tr>
<tr>
<td>2. Project Description and Implementation</td>
<td>• Explore if the project is a part of larger transport strategy&lt;br&gt;• Give an overview of the implementation difficulties.</td>
</tr>
<tr>
<td>3. Demand Forecasting</td>
<td>• Gather information to compare planned and actual figures and trends, in order to draw conclusions on:&lt;br&gt;• the reliability of the assumptions, demand analyses.</td>
</tr>
<tr>
<td>4. Financial Analysis</td>
<td>• Gather information to compare planned and actual figures and trends, in order to draw conclusions on:&lt;br&gt;• the reliability of the assumptions and financial analyses; and&lt;br&gt;• the financial sustainability of the investment.&lt;br&gt;• Explore the impacts of financial aspects (including the financial analysis if it affected project delivery) on the implementation of the project.&lt;br&gt;• Identify institutional factors that are critical to...</td>
</tr>
</tbody>
</table>

---

89 Major Projects are defined as those with a total cost of over €50m
90 Budapest Metro Line 4 (Section I) - 2008HU161PR003
produce reliable financial analyses (including demand analyses).
- Identify systematic biases (i.e. regularly occurring similar difference between assumptions and facts) in making assumptions.
- Analyse the solutions that are put in place to ensure the financial sustainability of investments.

5. Lessons Learned
- Identify lessons to improve the quality of the remaining case studies.

Table 10.2 contains a list of the key stakeholders who were interviewed regarding the Budapest Metro Line 4 project. The purpose of each interview was to explore particular issues, assumptions or changes in project context, and gain a better understanding of the project implementation and operation.

**Table 10.2 – Stakeholders interviewed**

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Role and Relationship to the Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipality of Budapest</td>
<td>The Municipality of Budapest is the local authority of Budapest with ultimate responsibility for public transport provision and operation. BKV and BKK (see below) are wholly owned by the Municipality.</td>
</tr>
<tr>
<td>BKK</td>
<td>BKK (Budapesti Közlekedési Központ/Centre for Budapest Transport) was established in 2010 after the project application for Metro Line 4 but during the implementation of the project. BKK contracts public transport services in Budapest including Metro Line 4. BKK’s remit includes collection of fares along with planning and developing the public transport system in Budapest.</td>
</tr>
<tr>
<td>BKV / DBR Metro</td>
<td>BKV is the public transport company of Budapest. BKV supplies bus, trolley bus, tram, metro and suburban rail services. DBR Metro is the project management directorate of BKV that managed the implementation of Metro Line 4.</td>
</tr>
<tr>
<td>Ministry of National Development</td>
<td>The Ministry of National Development is the Managing Authority for the transport operational programme for Hungary. The NFÜ (National Development Agency) was the Managing Authority at the time of the project application. However, this agency was subsumed into the Ministry of National Development at the end of 2013.</td>
</tr>
</tbody>
</table>
JASPERS (Joint Assistance to Support Projects in European Regions)\textsuperscript{91} provided support to the Hungarian authorities in their application for European cohesion funding for Metro Line 4. This support included assistance in drafting the project application, compiling the cost benefit analysis and identification of key success/risk elements of the project. In addition to the support on this project, JASPERS provide a range of support to the Hungarian authorities and therefore have knowledge of the wider policy context of the project.

\textbf{Summary of the project}

Opened in March 2014, Metro Line 4 links east and west Budapest over a 7.34 km route incorporating ten stations. Metro Line 4 is located in central Budapest linking Kelenföld station to the west of the Danube (Buda) with Metro Line 3 and Metro Line 2 at its terminus on the east of the Danube (Pest). This is shown as Section 1 in Figure 10.1 below. Section 2 was examined but not progressed.

\textbf{Figure 10.1 – Budapest metro line 4}\textsuperscript{92}

The project connects Kelenföld railway station with Keleti railway station east, providing interchange opportunities with heavy rail, two other metro lines and surface modes. Prior to the opening of this scheme, the Budapest metro system consisted of three metro lines – the first of which is the oldest metro line in continental Europe\textsuperscript{93}.

A planned subsequent phase of Metro Line 4 (Section 2) involved a potential extension to the north east of Keleti station with a further four stations. This potential additional

\textsuperscript{91} JASPERS interview was conducted via telephone due to their location in Vienna

\textsuperscript{92} Source: Budapest Metro Line 4. / Section I Cohesion Fund Application (March 2009)

\textsuperscript{93} The first underground railway in Europe was the Metropolitan Railway in London, UK
phase was examined in the ex-ante evaluation of Metro Line 4. This extension has not been developed to-date and does not feature as a priority in current transport plans. The Municipality of Budapest and BKK indicated that demand on this section of the corridor is planned to be met by a tram line at circa 15% of the capital cost of the metro option.

Metro Line 4 includes twin bore tunnels, ten metro stations (Figure 10.2), turning boxes beyond each terminus, rolling stock and depot facilities (located at Kelenföld). The 15 four-carriage metro trains each have a capacity for 807 passengers. Trains travel at a maximum of 80km/h with a minimum headway of 90 seconds. Journey time from end to end is under 15 minutes. Although trains do not require a driver, one is in place on all trains to intervene should any issues arise. Stakeholders noted that this practice is likely to be phased out in the future.

Figure 10.2 – Budapest metro line 4 – Kálvin Square Station

Included in the project are additional refurbishment and traffic calming measures at five of the metro stations. These measures include reduced number of car lanes, widened walkways, pedestrian underpasses and revitalization works.

Ancillary developments planned to be implemented alongside the scheme have not yet been delivered. At Kelenföld station, the project was planned to include a new intermodal hub. A revised motorway intersection (M1 & M7) would provide improved access for suburban and inter-city buses and a 1,200 place park and ride facility. The Budapest Municipality estimate the cost of developing the intermodal hub is circa €15-20m and is a priority for development. It is therefore considered likely to be developed in the near term. It should be noted the source of funding for these ancillary developments was not included in the Metro Line 4 project application.

Metro Line 4 increases public transport capacity providing the opportunity to implement enforcement measures such as congestion charging. Enabling such a

94 Source: May 2015 Budapest Visit by AECOM/KPMG evaluation team
95 Kelenföld, Fivám, Kálvin, Rákóczi and Keleti
The project involved the reconfiguration of existing public transport – predominantly buses and trams. This included replacement of some services and realignment of others. Since opening in March 2014 Metro Line 4 has attracted a high level of patronage. It provides a key high capacity link in Budapest’s public transport network.

Project selection
The first metro line in Budapest (Metro Line 1 – the millennium line) opened in 1896. The next two metro lines (2 and 3) opened in the 1970s. At this point planning for a fourth metro line between Kelenföld and Keleti railway stations began.

Detailed planning and assessment of the Metro Line 4 project began in 1995. Studies were completed in 1996\(^{96}\) and 1998\(^{97}\). The feasibility of the project was carried out in two stages. The first examined the different transport options (including various modes of public transport). The output of the first stage identified a metro as the preferred option. The second stage refined this analysis and examined the implementation and financing aspects of the project.

The first stage of the feasibility assessment examined the corridor of interest – from the south western suburbs to the city-centre. The aspects examined included land use, population, employment, transport conditions and transport demand. A transport model was constructed using a range of data including transport count data (1992-1994), origin-destination household survey data (1992-1994), origin-destination passenger survey data (1988), employment and population data (Central Statistics Office) and additional data from public transport providers and stakeholders. In addition, public transport surveys were carried out over the course of the study.

Three main groups of alternatives were examined to serve this corridor: bus/tram; Light Rail Transit (LRT) which would be fully segregated; and metro with full segregation and significant underground sections. A number of sub-options were developed within each grouping and these were assessed using cost benefit analysis (CBA) and Multi-Criteria Analysis (MCA). A number of metro options and an LRT option (via Fehérvári) were considered the best options.

The metro option via Tétényi was selected as the preferred option by the Steering Committee. This was taken forward to the second stage. It should be noted that the cost estimate for this option (and potentially all options) was below the final level
realised. Adjusting for inflation, the final cost is of the order of 50% higher than originally forecast. The financial analysis section below provides further detail.

In addition, the 1996 demand forecasts were in excess of those made at a later stage of assessment (2009\(^{98}\)). A key purpose of the updated 2009 CBA was the use of revised transport data based on changes in territorial, economic and traffic circumstances.

The second stage examined the alignment in further detail including a shorter route from Kelenföld to Kálvin Square, extensions to the north east and south west and other factors such as train capacities. The outcome of this stage was the preferred option for Metro Line 4 which is effectively what is now in operation. It is notable that the inclusion of the section for Kálvin Square to Keleti was of particular importance in terms of the economic benefits of the scheme. Neither proposed extension (i.e. beyond Kelenföld or Keleti) warranted inclusion based on this analysis.

Metro Line 4 was concluded as the best solution for meeting the needs of this transport corridor linking Kelenföld and Keleti stations with eight intermediate stops.

The process for the prioritisation of Metro Line 4 over other transport projects or indeed other public investment projects both in Budapest and Hungary as a whole is not clear from the evidence available. Given the scale of this project, it is surprising that a greater degree of scrutiny was not placed on the selection of Metro Line 4 at a local and national level.

In 2003, the Hungarian Parliament approved funding for Section 1 of Metro Line 4 with funding from EU cohesion funds approved in September 2009.

### 10.3 Project context and implementation

#### Introduction
This section of the report presents an overview of the objectives of the project, the policy context within which it was delivered and the implementation difficulties experienced. It therefore addresses the following items from the ToR:

- To explore if the project is a part of larger transport strategy; and
- To give an overview of the implementation difficulties.

#### Objectives
As detailed in the 2009 Financial and Economic Appraisal, the socio-economic objectives of the project are:

- to increase the competitiveness of the capital of Hungary in the global trade;
- to contribute to the increase of economic potential of the city;
- to attract investors and business activities into the capital and her agglomeration;

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\(^{98}\) Budapest Metro Line 4 Section I – Financial and Economic Appraisal (March 2009)
to improve the connection with the neighbouring settlements by extending the rail-based network of Public Transport providing better opportunity for Park and Ride;

to improve the liveability for the citizens and the tourists;

to slow down the unfavourable change of the modal split, to improve the patronage of public transport;

to decrease the demand for parking cars in the city centre;

to provide better accessibility;

to decrease the negative environmental impacts of using private cars in the city centre: to decrease air pollution, noise, vibration, accidents, congestion, delay, stress because of the unreliability of mobility, decrease the climate change effect, to improve transport safety;

to decrease the travel time and improve comfort for passengers using Public Transport directly and indirectly for those, using individual transport mode;

to increase transport capacity for traffic crossing the Danube;

to leave more space on the surface for non motorized transport activity (e.g. walking, etc.);

to improve the conditions of mobility in the city for visitors and tourists with working, learning, shopping, cultural, recreational, etc. purposes and activities;

to improve the productivity, cost effectiveness and efficiency of the Public Transport operator; and

to create possibility for managing the traffic demand in the longer future.

**Policy context**
In the early stages of its development, Metro Line 4 appears from project documentation to have been planned in relative isolation. The potential impact of the project on a range of elements such as other modes of transport, land use, development planning and the development of Budapest were not examined.

In 1996, at the time of the feasibility study, the Master Plan for Budapest and Transport Development Plan were being reviewed. The previous such review was in the 1980s. Although the planning for Metro Line 4 did take account of these plans and the preliminary findings of their review, there was no combined development process involving decisions on Metro Line 4 and these plans. Given the scale of the project this would have been advisable in the view of the evaluators.

Since the decision to develop Metro Line 4 was made, transport planning in Budapest has made significant progress. One such notable development is the creation of the Centre for Budapest Transport (BKK) in 2010. This institution contracts the majority of
public transport services in Budapest. The public transport company of Budapest is BKV which supplies bus, trolley bus, tram, metro and suburban rail services. BKK and BKV are both wholly owned by the Budapest Municipality with public service contracts in place between the Budapest Municipality and BKK, and between BKK and BKV.

BKK provides a single institution that finances, plans and develops the public transport system in Budapest. The formation of BKK allows for the development of an integrated and transparent transport budget. All fares and advertising revenues are collected by BKK with additional funds supplied by the Hungarian State, Budapest Municipality and, for specific projects, EU Cohesion Funds.

A further benefit of the formation of BKK is the ability to develop an integrated transport strategy for Budapest. The BKK has published such a plan in draft format. The Budapest Transport Development Strategy 2014-2030\(^9\) examines all modes of transport and their development in an integrated manner. It is expected that this plan will be formally ratified in the coming months. JASPERS has identified the creation of BKK as a critical factor in promoting efficient public transport planning in Hungary.

**Project implementation**

Following preparatory works above ground, the construction of Metro Line 4 commenced in 2006. At the time of lodging the application for Cohesion Fund assistance in 2009, the project was circa 50% complete and it was estimated that services would commence by the end of 2011 (a five-year construction period). Services commenced on Metro Line 4 in March 2014 (a seven-year construction period). The 2009 Cohesion Fund application estimated the project cost to be €1.42bn with €729 million being provided by Cohesion Funding. Current estimates are for a project cost to be circa €1.45bn\(^1\).

Construction was procured by BKV and managed by DBR Metro (the project management directorate of BKV). A key factor in the implementation of the project was the method of contracting. There was no single contract issued for the design and construction of the project. Instead, separate contracts were issued for distinct elements of work. The exact number of contracts could not be determined from available evidence but it has been confirmed by stakeholders that there were 17 principal contracts and in excess of 200 contracts in total. Although many of these contracts were for relatively minor works, major works were also procured through separate contracts.

For instance, the contract for the construction of the twin tunnels running from Kelenföld to Keleti was awarded to Bamco\(^2\) while the construction of stations was awarded under separate contracts. Similarly, the rolling stock was procured from Alstom and the traffic control system from Siemens under separate contracts despite the two being intrinsically linked. This resulted in disputes with the Alstom contract (with BKV cancelling the contract) having knock-on impacts with the Siemens contract.

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\(^9\) Budapest Transport Development Strategy – Balázs Mór Plan (BMT) published as Draft for Public Consultation by BKK

\(^1\) Source: Ministry of National Development – June 2015

\(^2\) Bamco was a consortium of Vinci, Strabag and Hídépítő Zrt
The interviewees all noted that the need to procure future projects via a single contractor was a key lesson learned from the implementation of Metro Line 4. It has not been possible to determine why such a procurement strategy was implemented or what, if any, consideration was given to using a single ‘general contractor’ for the project. A key factor in this lack of insight is the change of personnel in many roles since procurement commenced. A result of the procurement strategy employed was interface issues between contracts. By employing individual contracts, the risk and resultant cost invariably lay with the Hungarian authorities (i.e. BKV and therefore the Budapest Municipality). For instance, where a dispute or delay arose (such as when tunnelling operations were halted by Bamco during a dispute in 2009), the resultant impact on other contractors and the overall project timeline generally resulted in a level of additional cost to BKV.

Further contracting issues related to public procurement procedures. As a result, eleven contracts were excluded from the eligible costs for cohesion funding due to non-compliance with public procurement law. This resulted in a reduction of the cohesion funding from €904m (in the March 2009 application) to €729m (based on June 2009 financial correction proposal). Subsequent to the project being approved, there were further contract issues with payments suspended by the European Commission in September 2010 and a correction of €278,600 applied.

There were many underlying reasons for delays. For instance, commencement of tunnelling works was delayed by six months due to land acquisition procedures. It is also highly likely in the view of the evaluators that the original project programme was overly optimistic and did not include adequate contingency for potential issues. It is estimated that a construction of an urban metro scheme would take between 3 and 7 years. This estimate is based on a series of equivalent projects (including metro projects) identified as benchmarks\textsuperscript{102}. This range provides a general guide to the expected construction duration of a such a project. By their nature metro projects vary significantly in terms of technical and environment considerations. In addition, institutional factors such the level of development of procurement and project management in the managing intuitions can impact the likely timescale. Given the scale and complexity of the Metro Line 4 scheme – in particular the river crossing and ground conditions – the higher end of this range would be considered appropriate. The 1996 feasibility study forecast a four year construction period and the 2009 funding application envisaged completion by 2011 with circa 50% of the scheme already completed. The scheme commenced operation in 2014. It is therefore considered likely that the timeline for the delivery of Metro Line 4 was underestimated.

During the early phase of construction, the project was supported by the Budapest Municipality but criticised by some political opponents. In 2010, there was a change of political leadership in the Budapest Municipality. The new leadership, who were previously critical of the project, undertook to complete Metro Line 4. However, they were (and continue to be) strongly critical of the issues associated with the implementation of the project and associate all such issues with the previous administration. Contact with the previous administration has proven problematic due

\textsuperscript{102} See First Interim Report
to the political party no longer being active in Hungary. There was no evidence that the financial aspects of the project influenced its implementation.

10.4 Demand analysis

Introduction
This section of the report presents an overview and high level judgement of the demand analysis assumptions relevant to the project addressing the following item from the ToR:

- To gather information to compare planned and actual figures and trends, in order to draw conclusions on the reliability of the assumptions and demand analyses.

Review of assumptions
The economic and financial appraisals of Metro Line 4 were heavily dependent on the forecast demand: the number of passengers using the scheme. A high level summary of the demand analysis carried out for Metro Line 4 is shown in Table 10.3 below. A RAG (Red:Amber:Green) classification has been used to summarise the rigor of assumptions:

- Red [R]: No robust evidence to support assumptions was evident;
- Amber [A]: Evidence to support assumptions was available but varied in quality; and
- Green [G]: robust evidence of assumptions was presented.

<table>
<thead>
<tr>
<th>Table 10.3 – Thematic demand analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics Summary</td>
</tr>
<tr>
<td>The 1996 feasibility assessment examined the corridor of interest including land use, population, employment, transport conditions and transport demand. A transport model was constructed using a range of data. An updated traffic impact study was carried out in 2009. This also included data from a 2004 household survey (50,000 household) and a 2006 public transport passenger survey.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Competing Modes Summary</th>
<th>Scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The feasibility study (1996) examined alternative modes (bus/tram, LRT and metro). Within each of these modes, a range of alignments was examined. As a result of this, the current metro alignment was selected.</td>
<td>A The process of mode selection and route alignment was reasonably robust. However, the specific reason for choice of metro over the best alternative LRT option is not clear. In addition, the</td>
</tr>
</tbody>
</table>
Ex Post evaluation: Transport

### Demographics Summary

| Scoring | selection of mode was not revisited in the 2009 study when demand levels were forecast to be much reduced (it is acknowledged that the project was 50% complete at this stage). |

### Consumer Behaviour Summary

| Scoring | The methodology applied could be improved by inclusion of a sensitivity analysis. |

**Demand analysis undertaken in the traffic forecasting model for Metro Line 4 uses nationally published data and survey data. No sensitivity analysis appears to have been carried out (e.g. economic growth, employment growth etc.).**

**The methodology applied could be improved by inclusion of a sensitivity analysis.**

### Affordability/Tariffing Summary

| Scoring | The calculation of fare revenue is considered suitably robust. |

**The financial evaluation is carried out using an incremental methodology. This applies to both costs and revenues. Additional fare revenues are based on additional public transport users. Allowance is made for fare avoidance and monthly ticket users.**

**The calculation of fare revenue is considered suitably robust.**


**Verification of assumptions**

The level of demand forecast to use Metro Line 4 is reported as the total number of boardings. The number of boardings that are additional (new) public transport boardings is also estimated.

As shown in Table 10.4 below, the majority of boardings forecast on Metro Line 4 are diverted from other forms of public transport. This is expected given that the project involves realignment of surface modes.
### Table 10.4 – Demand forecasts – weekday boardings

<table>
<thead>
<tr>
<th>Stage</th>
<th>Year</th>
<th>Weekday Boardings</th>
<th>Additional Weekday Boardings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996 Feasibility Study</td>
<td>2020</td>
<td>474,000</td>
<td>36,000</td>
</tr>
<tr>
<td>2009 Traffic Impact Study</td>
<td>2013</td>
<td>307,000</td>
<td>15,000</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>322,000</td>
<td>17,000</td>
</tr>
<tr>
<td></td>
<td>2027</td>
<td>336,000</td>
<td>19,000</td>
</tr>
</tbody>
</table>

The 2009 Traffic Impact Study shows a sizeable reduction (32%) in the level of boardings predicted for 2020 compared to the 1996 feasibility study. The 2009 study included revisions of transport data based on changes in territorial, economic and traffic circumstances.

It is notable that the higher level of boardings predicted in the 1996 feasibility study may have led to a metro solution being preferred to an LRT solution based on its ability to handle higher capacities. Given the construction of Metro Line 4 was approximately 50% complete at the time of the 2009 study, it is not surprising that the mode choice was not revisited.

The comparison of forecast demand with actual demand is not straightforward. The main complication is the method of ticketing in Budapest with all public transport fares collected by BKK. Tickets are valid across all public transport modes. As such, a ticket is not purchased for a specific journey or indeed a specific mode. In addition, the metro is essentially an open system. Although single tickets must be validated on entering the system, there are no barriers and no checks on leaving the system. The presence of staff at the entrance to all stations ensures high compliance with validation procedures. However, many tickets (e.g. monthly passes) do not require validation.

A final complication is that Metro Line 4 interchanges with two other metro lines with the result that journeys commencing at interchange stations may be for one or other line and additionally journeys may use Metro Line 4 without entering at any of its stations (i.e. by interchange). The Hungarian Central Statistics Office (Központi Statisztikai Hivatalt – KSH) publishes transport data on a regular basis. In a March 2015 publication\(^\text{104}\), KSH state:

“With the installation of Metro Line 4, the proportion of subway passengers increased from 15 to 19%, and in terms of passenger kilometres travelled from 18 to 22%.”

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\(^{103}\) Updating Traffic and Impact Study of metro Line M4 (TRANSMAN, Mark 2009)
\(^{104}\) Statistical Reflections, Transport performances and road traffic accidents, Quarter 4 2014 www.ksh.hu/docs/eng/xftp/gyor/sza/esza21412.pdf
BKK have provided data from a survey of Metro Line 4 carried out in December 2014 which is shown in Table 10.5.

Table 10.5 – 2014 passenger boardings – forecast (in 2009) and survey results (2014)\textsuperscript{105}

<table>
<thead>
<tr>
<th>2009 Forecast</th>
<th>2014 Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weekday</td>
<td>Weekday</td>
</tr>
<tr>
<td>309,000</td>
<td>158,000</td>
</tr>
</tbody>
</table>

It is clear from the limited data available that there are substantial numbers using Metro Line 4. However, the passenger demand appears to be significantly less than forecast – circa 50% less than the 2009 forecast.

The data on which the 2009 forecasts were made predate the economic crisis in 2007/8 and no update was carried out to account for the changed circumstances (e.g. changed level of government spending). The forecast level of demand was reduced from 1996 to 2009. However, the full effect of the economic crisis is not reflected in the updated estimates.

The survey was carried out in the first year of operation of the scheme. Large infrastructure projects (such as Metro Line 4) will generally see the level of transport demand ‘ramp up’ over the first few years. This reflects the time it takes for transport users to adjust their behaviour compared to the modelled output which assumes an immediate change. Based on AECOM’s experience of rail projects, a level of circa 80% of modelled demand is expected in the first year of operation increasing to 100% by year three. The level of demand is influenced by a range of factors including the withdrawal or reduction of alternative means of transport as is the case in Metro Line 4.

If it is assumed that the 2014 survey results reflect 80% of modelled output, this would imply a 100% level of almost 200,000. This is reflected in the targeted patronage of circa 200,000 by 2016 indicated by the Municipality of Budapest and BKK. This would correspond to circa 60% of forecast demand in 2016.

An evaluation of the Metro Line 4 project is planned for later in 2015 and it is expected that further surveys will be carried out to more accurately determine the level of demand. There are three reasons that the gap will close between the levels of passengers using Metro Line 4 and the level forecast:

- Metro Line 4 opened in March 2014 and therefore the survey of passenger demand (Dec 2014) is after less than one full year of operation – the ‘ramp up’ effect;

\textsuperscript{105} Source: 2009 Economic Appraisal and BKK survey data
• Growth in overall metro traffic in Budapest (2012: 1.1%, 2013: 1.3%) is higher than forecast in the traffic study (0.7% average annual growth); and

• Other elements of the project will be completed in the coming years – e.g. a 1,200 space park and ride facility and revised motorway junction is planned for Kelenföld station.

For these reasons, the gap between the level of passengers forecast to use Metro Line 4 and actually using the scheme over the coming years may close. In the following section the future level of growth required in order to economically justify the project is examined.

10.5 Financial analysis

Introduction

This section of the report addresses the following elements from the ToR:

• To gather information to compare planned and actual figures and trends, in order to draw conclusions on:

  • the reliability of the assumptions and financial analyses; and

  • the financial sustainability of the investment;

• To explore the impacts of financial aspects (including the financial analysis if it affected project delivery) on the implementation of the project;

• To identify institutional factors that are critical to produce reliable financial analyses (including demand analyses);

• To identify systematic biases (i.e. regularly occurring similar difference between assumptions and facts) in making assumptions (where the financial analysis contained methodological errors, the contractor will recalculate the financial analysis); and

• To analyse the solutions that are put in place to ensure the financial sustainability of investments.

Overview of financial analysis

The financial analysis of Metro Line 4 includes three key elements: namely the capital cost; operation & maintenance cost; and revenues.

The exact final capital cost of the project is not yet known. The current estimate of the final cost, along with previous estimates, is provided in Table 10.6 below.
It is clear that there has been significant cost escalation from when the initial feasibility study was carried out. This is explained by the high level of inflation in this period with annual average consumer price inflation of 8% in the decade from 1996 to 2006.

When adjustment is made for inflation, the increase from the financial appraisal to project application is circa 20%. This is likely to be due to a range of ancillary issues including changes to the scope of works as a result of more detailed design.

Based on data provided by the Managing Authority (Ministry of National Development) the current estimated final cost is circa 28% greater than the level estimated in the project application when evaluated in local currency terms. The appreciation of the Euro with respect to the Hungarian Forint makes this increase appear small as shown in Table 10.6 above.

The Managing Authority has indicated that the majority (over three quarters) of this additional cost is due to the claims from other contracts resulting from delays associated with the tunnel construction.

In the early years of the development of the project, the government withdrew support after determining that the costs would be circa 60% higher than forecast in 1996. This resulted in delays and legal procedures between the municipality and the State. These difficulties were overcome with a subsequent agreement between the Budapest Municipality and the State put in place in 2004.

Subsequent to the application for funding to the EU and the development of an updated CBA, the cost increase is estimated to be circa 28% in local currency. This financial impact is considered to be a result of (as opposed to the cause of) delays in delivery of the project.

The underestimation of costs and project timeline are considered a systemic bias within the project. Although the updated appraisal in 2009 included an allowance for cost overrun and delays, further cost and time overruns were encountered.

The absence of BKK, or a similar organisation, overseeing the planning and development of transport in the wider Budapest area is considered a key institutional factor in the delays and cost overruns encountered during the Metro Line 4 project.

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Table 10.6 – Cost of metro line 4 - Cbn

<table>
<thead>
<tr>
<th>Stage</th>
<th>€ bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996 Financial Appraisal – Stage 1 (1996 prices)</td>
<td>0.45</td>
</tr>
<tr>
<td>1996 Financial Appraisal – Stage 2 (1996 prices)</td>
<td>0.51</td>
</tr>
<tr>
<td>2009 Project Application (2006 prices)</td>
<td>1.42</td>
</tr>
<tr>
<td>Estimated Final Cost¹⁰⁷</td>
<td>1.45</td>
</tr>
</tbody>
</table>

¹⁰⁶ These costs only include the Metro Line 4 project and do not include ancillary elements previously discussed which are to be implemented from other funding sources.

Cohesion funding was expected to contribute €729m to the cost of the project. The actual final contribution has yet to be determined. It has been agreed that the remaining cost of the project will be paid 21% by the Budapest Municipality and 79% by the Hungarian State.

In overall economic terms, the 2009 cost benefit analysis forecast a net present value of €530m (2006) and an Economic Benefit to Cost Ratio (EBCR) of 1.58.

As the scheme has been operating for just over one year, the comparison of operation and maintenance costs and revenues to forecasts may not provide an accurate assessment of the long-term financial validity of the project. For instance, the metro trains are driverless but drivers are employed to sit in each train and intervene should an issue occur. The cost of these drivers is not expected to remain in the long-term.

Similarly, the estimates of passenger demand levels and therefore fare revenues are far from clear at this stage. BKK noted that a 0.5% increase in total fare revenue (circa €1m) was forecast for 2014. However, the proportion due to Metro Line 4 is not known. The fare revenues assumed in the cost benefit analysis are assessed on additional public transport passengers. The level of additional customers is relatively low with the majority of predicted patronage being diverted from existing public transport modes. The evaluation that is planned to be carried out in 2015 should provide greater clarity on these issues.

BKK have noted that fares collected by them are used to contract public transport services (including Metro Line 4) from BKV. The contract between BKK and BKV includes funding for operation and maintenance, and service levels with associated financial penalties for non-compliance. The Budapest Municipality estimates that circa 35% of the cost of BKV is financed through fare revenues collected by BKK. The remainder is provided by the Hungarian authorities.

Overall, there are two key concerns that the financial analysis has identified: namely the higher level of capital cost; and lower level of demand when compared to forecasts. It is also notable that the appraisal carried out in 1996 (which was used as a basis for proceeding with the project) has lower cost and higher demand predictions than forecast in 2009.

The breakdown of benefits associated with the scheme is shown in Figure 10.3 below. This shows that approximately two-thirds of the benefits of the scheme are travel time savings for passengers.
The majority of these travel time savings are associated with users of public transport (32%) and existing car users (32%). A relatively small proportion (2%) is associated with users converting from cars to public transport.

The realisation of time savings for public transport users is directly linked to the level of passenger demand using Metro Line 4. The realisation of time savings for car users is based on the impact of the scheme on surface travel. This includes the reduction of bus services and road improvement works. As such these benefits are likely to be indirectly linked to the number of passengers using Metro Line 4. Many of the other benefits such as vehicle, accident, pollution, climate change and noise costs are similarly linked to the surface improvements.

Overall, it is considered that one-third of the benefits are forecast to be directly related to the level of demand with the remaining two-thirds indirectly related. Should the current shortfall in forecast demand (60% of forecast level - when adjusted for the ‘ramp up’ effect) continue for the life of the scheme, the benefits are therefore likely to reduce by between 13% and 40%. The former would assume the two-thirds of non-public transport user benefits are not related to Metro Line 4 demand whereas the latter assumes they are directly related. The reality is likely to be somewhere in between.

As the time savings constitute a significant proportion of the benefits associated with the scheme, the value of time used and, in particular the growth rate of that value, can have a significant impact on benefits. The CBA was based on an annual average growth rate in the value of time of 2.6% over the appraisal period. The growth in value of time is directly related to income which, in general, is approximated by the growth in GDP per person employed. Examination of the latest Convergence Programme submitted by Hungary and the European Commission’s response indicated that, in the short term, a rate of circa 1% is likely to be realised. Although a higher rate may be realised in the long-term, a rate of 2.6% would require a sustained period of growth in real income and is therefore considered optimistic. In order to test the impact of variations in the assumptions discussed, the CBA has been reevaluated based on the following:

108 Source: 2009 Economic Appraisal
- Increase in capital costs of 28%;
- Reduction in public transport user time benefits of 40%;
- Reduction in other benefits in the range from 0% to 40%; and
- Reduction in the annual growth in value of time in the range from 0% to 50%.

This results in a revised EBCR in the range from 0.6 to 1.1. This compares to an EBCR in the 2009 CBA of 1.6 (1.58).

This raises significant questions over the economic merits of the scheme. It would appear that if all of the benefits to surface transport are delivered and the value of time growth is as forecast, a demand level of 60% using Metro Line 4 would lead to the scheme being economically positive – albeit marginally.

Assuming the lower level value of time growth (i.e. 50% of that forecast in the CBA) and the surface transport benefits being directly related to Metro Line 4 use, the level of demand would need to be circa 95% of that forecast in order to economically break even. This would require circa 320,000 passengers using Metro Line 4 by 2027 which equates to an annual average increase of circa 4%. Given the annual average growth rate of metro traffic in Budapest has circa 1.2% in recent years, a growth rate of 4% is considered high. However, should this passenger growth level be achieved, Metro Line 4 is forecast to deliver a net positive economic return over its lifetime.

Financial sustainability

The operation and maintenance costs associated with Metro Line 4 were forecast to be largely offset by reduced operating costs of surface modes.

The long-term annual operation and maintenance costs are not yet known due to the first year of operation not being representative of the full life of the scheme. For instance, the vehicles are designed to be driverless. However, although they are operating in this mode, each vehicle continues to have a driver present who can take over at any point should the automatic systems fail to function correctly.

The long-term financial sustainability of the scheme can best be assessed by examining the level of cost savings associated with surface modes. A large number of changes have been implemented to surface modes along the Metro Line 4 corridor including:

- Decreased capacity of bus lines – e.g. 7, 7A, 7E and 107E decreased by 60%
- Cancellation of some bus services – e.g. rapid busses along corridor;
- Rerouting of bus lines – e.g. 8, 40, 40E, 87-187, 172, 250 rerouted to start from Kelenföld; and
- Frequency of tramline 49 has been decreased by 50%.

109 2012: 1.1%; 2013: 1.3%
BKK have indicated that further changes to surface modes will be implemented once other aspects of the project are completed (e.g. the motorway junction at Kelenföld).

In addition to the operation and maintenance costs, there are forecast savings of €34m (2006 prices) in renewal costs associated with surface modes over the lifetime of Metro Line 4.

The majority of passengers predicted to use Metro Line 4 are moving from other modes of public transport. As the fares charged across all urban public transport modes are common, there is no net fare increase associated with changing mode of public transport use. There are additional passengers forecast to use the scheme generating additional annual fare revenue of circa €0.7m (2006 prices).

Although there is insufficient data to quantitatively assess the financial sustainability of the project, there are significant savings being made in the operation, maintenance and renewal of surface modes. A further contribution is made by additional fare revenue. The forecast savings are larger than the fare revenue by a factor of three. Even if the shortfall in demand compared to forecasts continues, the impact on the scheme should therefore be relatively low.

Overall, there is a strong potential for Metro Line 4 to operate in a financially sustainable manner.

10.6 Lessons learned

As this is a pilot case study, the lessons learned are summarised with a view to informing and improving the content of the remaining case studies.

- The interview with JASPERS provided very useful background and understanding of the key stakeholders and an unbiased view of the project. As the relevant JASPERS team are located in Vienna, a phone interview was conducted. This happened in advance of the visit to Budapest and was particularly useful. If the JASPERS team for Hungary was based in Budapest, this meeting would have happened along with the other interviews. It would therefore not have provided as good a preparation for the other interviews. For future case studies, consideration should be given to identifying specific interviewees (such as JASPERS) and carrying out these as phone interviews in advance of the main interviews in order to increase the value from subsequent interviews.

- The level of data available on the scheme is relatively limited. Indeed it is quite surprising that given the scale of the project, only a single survey of patronage is available. It is therefore considered imperative for future case studies to examine data availability at an early stage.

- In the case of all interviews, information was sent prior to the interview outlining the project and what it entailed. Nonetheless the response from interviewees was generally one of suspicion. As the visit to Budapest happened after the other pilot case study, the team were prepared for this and commenced each meeting with a detailed explanation of the project.
This helped ease the interviewees’ fears and should be continued in future case studies. Nonetheless, it is believed a level of cautiousness remained.

- In terms of sourcing background and qualitative information, the interviews worked well. However, this was not a suitable forum for sourcing quantitative data. Although the information being sought was requested in advance of the meetings, no interviewees provided this data. However, in the meetings individuals did commit to providing data which is being followed up on. Consideration should therefore be given to allotting extra time in the programme after the meetings take place for further interaction with the interviewees (via telephone or email) to gather further information and secure additional data.
11 Task 3 Conclusions

The evaluation of the ten major projects was able to verify the correctness of assumptions to varying extents. For example, there was no outturn demand data for four of the projects. Where outturn demand data did exist, it commonly differed from ex-ante forecasts due to the economic recession reducing overarching travel demand or poor forecasting of demand abstracted from/by competing modes.

Evidence was more commonly available through which to verify the forecast construction costs. The economic recession was commonly cited as resulting in lower tender prices offered by contractors than forecast. Reasons for inaccuracies in forecast costs included the low level of preparatory work undertaken during pre-construction periods.

As a consequence, variance was observed between forecast and observed/anticipated EBCRs. However, there was consensus among stakeholders across all projects that the factors influencing demand and cost were short term in nature, such as the recession, and that the projects represented good value for money.

The main findings from the major project case studies are summarised below:

- The approach to project prioritisation within the operational programme varied, but location on the TEN-T was an important factor in all cases and in some Member States the principal rationale for promotion of all projects. Other Member States had more developed national transport plans and strategies providing tools for a more sophisticated approach to project prioritisation.

- The majority of major projects evaluated (all of the eight reported here, and nine of the ten evaluated in this commission) were located on the TEN-T, and as such had objectives to deliver international, national and regional connectivity improvements. It should be noted that the 10 selected case studies are not representative of all major projects or Cohesion Policy supported projects.

- The approach to tendering in the Member States that joined the European Union in 2004 or 2007 has often been price only (and this applies across projects in these Member States). In combination with the timing of the global economic recession during the 2007-13 programming period, this influenced the pricing strategies of contractors who presented low tender prices. This has resulted in low prices compared to forecasts. This generated an increased risk and occurrence of contractors defaulting during construction, resulting in delays to delivery. However, the lower tender costs than forecast (with Application Forms) ensured that projects were delivered within forecasts despite cost escalation during construction.

- FIDIC (see footnote 7 on page 17) was the most common contract applied on projects (three projects used the red form and one the yellow). The remaining projects relied upon contract types specific to their Member State.
Some cases demonstrated poor project preparation, leading to delays and some cost escalation. Low quality detailed designs and a lack of ground investigation were examples of factors that influence the maturity of projects. These issues were most commonly observed on projects adopting a red FIDIC contract approach, and where the design works were undertaken by the employer rather than the contractor. Other cases demonstrated good preparation in areas such as land acquisition, which resulted in timely delivery and tighter cost controls.

Three projects were completed on time or ahead of schedule, the remaining four experienced delays. Reasons for delays included contractor issues and unforeseen issues such as ground conditions.

The EBCR of railway schemes ranged from 1.03 to 1.4, whilst for highways schemes the range was from 1.8 to 4.2. These distributions are in line with industry norms, and a consequence of the relatively high cost per km construction or modernisation costs of rail projects, and the higher journey time benefits realised by highway projects\textsuperscript{110}.

Some projects were part of wider corridor investment plans, with EBCRs calculated assuming the entire corridor or line has been enhanced. This introduces a challenge for the Commission in terms of assessing the value for money of individual projects. However, projects that were a continuation of previous investment were generally more mature and represented lower risk compared to new, individual projects.

The level of consideration of project interaction with other routes and modes varied across projects. The long-term planning and prioritisation by individual Member States was a factor observed in the level of analysis undertaken, resulting in feasibility studies assessing preferred options only.

The ring-fencing of revenue for operation and maintenance requirements was limited among those revenue generating projects. This resulted in a reliance on national funds for the ongoing operation and maintenance of projects.

There was very limited outturn demand data available. Reasons for this included the short period following construction and a lack of project-specific data collection.

\textsuperscript{110} See Section D of First Interim Report, pp145-147
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