JASPERS

CFPM Study

Country Report: Romania

September 2010

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1 Introduction

1.1 Objectives

The objective of this Country Report is to provide feedback to the Managing Authority and beneficiaries on how the Country is performing on construction cost control and management – in terms of both past performance in-country and present day performance compared to the other eight countries participating in the Study.

In the case of Romania, both road and rail sectors have participated in the Study. This report covers market context, cost estimation procedures, the use of Price Adjustment Clause (PAC) and risk management.

These Country reports are intended to complement cross-country overview reports which have been produced on cost benchmarking, cost development, cost estimation and use of the PAC and risk management.

Separate workshops covering Rail and Road construction risk management are being held in early 2010. It is intended to invite the beneficiaries and the managing authorities to these workshops when there will be time for discussion of the main findings of the country reports.

1.2 Layout of Report

The layout of this Country Report is as follows. First, in chapter 2, the broad context of the road and rail markets is presented.

Then, in chapter 3, the available evidence on construction cost inflation is presented. This comes from three sources: official cost and price indices, analysis of cost development, over project timelines, based on a sample of projects (Task 9 of our ToR), and the results of our work on cost benchmarking (Task 7 of our ToR) that is, comparing outturn unit costs/km in the Country in question with the other participating countries.

Chapter 4 reviews cost estimation methods and chapter 5 sets out the contract types and reports on use of the PAC in contracts in each sector.

Chapter 6 brings a range of considerations together under the over-arching theme of construction risk management.

Chapter 7 sets out and explores possible explanations for construction cost inflation and draws on international good practice– from both the participating countries and more widely – to set out a series of recommended actions which, if implemented, could enable more effective construction cost management.

1.3 Wider considerations

Before concluding this introduction, it is important to state some additional ingredients to the subject, not covered in the Report, to be borne in mind *ex ante*. Firstly, construction cost inflation is just as much a problem in "western" Europe and Worldwide, as in the nine participating countries. The nine should not feel that they are being singled out for criticism. Secondly, it has not been possible to explore the importance of institutional context in this Study. In Romania, institutional weakness is well known to be an issue in the transport sector and reports with action plans have financed by EIB[1].

In particular, the ability to employ sufficient numbers of suitably skilled and appropriately paid staff in the beneficiaries and managing authorities is likely to be a significant (if not the most significant factor) in construction cost management and, indeed, on the efficient delivery of the extensive road and rail development programmes much needed in Romania.

[1] See references [1] and [2].

2 Market Context

2.1 Introduction and objective

This chapter addresses Task 4 in the Terms of Reference. This task is concerned with the impact of market context and procurement methods on construction cost inflation in the road and rail sectors. The specific sub tasks are :

- Compare construction price index with consumer price index in included countries and comment on reasons for discrepancies.
- Identify the factors influencing the increases in construction cost in the road and rail sectors, such as (but not necessarily limited to).
  - construction costs (labour, materials, equipment etc);
  - market dynamics, addressing competitiveness; and
  - procurement, methodology, organisation and strategy (e.g. appropriate split of major projects into components to be tendered separately),

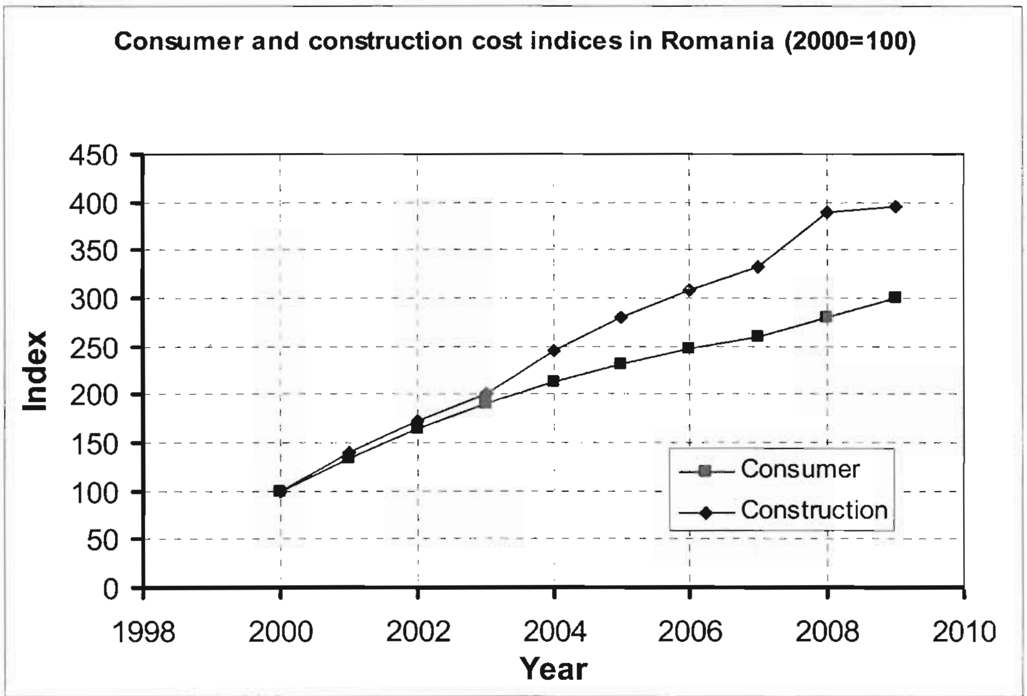
Some of the elements in Task 4 are covered elsewhere; in particular, contract types are discussed in chapter 5 and risk allocation in chapter 6. In view of the high degree of interaction between the subjects covered in each chapter, all recommendations are presented together in chapter 7.

2.2 Comparison of construction price index with consumer price index

2.2.1 Evidence

Figure 2.1 compares the consumer and construction price indices for Romania. This shows average consumer price inflation of 14% per year over the period 2000-2008. Construction prices have shown a higher rise over this period of 19% per year. The two indices showed similar growth up to 2003 when construction inflation began to increase at a higher rate.

Figure 2.1:



Source: National Institute of Statistics. Figure shown for 2009 are up to July only.

These data imply an increase in the cost of construction in real terms.

2.2.2 Consumer Price Index

The Consumer Price Index shows very high total growth from 2000 to the first half of 2009 of 200%. The greatest level of growth was from 2000 to 2002 when annual growth averaged 29% but since 2005 has slowed to an average of 7% a year.

2.2.3 Construction price index

From 2000 to the first half of 2009 the total growth in the Construction Price Index was 295%. Growth was very high over the period 2000-2004, averaging 25% per annum. Over the period since 2004 growth has slowed to an average of 10% a year, although there was a sharp rise in 2008 followed by lower growth in 2009 so far.

Construction inflation is a real challenge and when money is distributed from EU funds, for large scale infrastructure projects such as road, rail and aviation, there will be further significant pressure on the supply chain than that currently being experienced.

There are a number of factors that have driven construction inflation in Romania in the recent past:

- High demand in the private sector, especially in the residential sector from a growing young population with high levels of disposable income
- Demand by multinational corporations for office space in Bucharest
- Massive investment from foreign investors
- A boom in foreign financial programs
- EU funding on infrastructure investment
- Increased investment in public budgets for schools, healthcare, etc.

2.2.4 Observed tender prices

Construction prices have levelled off in the last year or so but appear to have moved up again in recent months.

2.3 Factors influencing construction cost increases: road sector

2.3.1 Input costs (labour, materials etc.)

2.3.1.1 Introduction

Costs of road construction have risen in recent years and were already high. In 2005 the World Bank issued a report pointing out that road rehabilitation costs were 30% higher in Romania than in neighbouring countries.

The years 2004 – 2008 saw a great deal of speculative investment in building construction (both residential and business) in Romania. This high demand drove up the price of cement, aggregates, timber, labour etc. across the construction market. Prices of diesel, bitumen, steel etc. rose sharply during this period in line with worldwide trends. Despite the fact that imports are readily available (in particular from Turkey) there is evidence of rising prices based on growing utilities and raw materials prices.

The local supply market is not very flexible. For instance it can take 2 years or more to obtain all the permits to open a new quarry. The two Romanian refineries are not equipped to ramp up production very quickly and in fact close-down in the springtime for maintenance (just ahead of the roads season). When demand increases rapidly the market takes some time to react. This results in too many contractors chasing too few goods.

Between 2004 and 2007 (the years leading up to Romania's accession to the EU) the Leu appreciated markedly against the euro. This led to a substantial increase in the euro cost of construction work in Romania. In the decade prior to this construction inputs tended to rise in local currency terms on average about 20% per year although this was largely off-set by an equivalent depreciation of the Leu.

The accession of Romania to the EU in January 2007 saw large numbers of labourers and skilled building workers go to work in Spain, Italy and other West European countries. This has contributed to a rise in labour costs for both skilled and unskilled workers in the construction sector. This is in addition to the "expectation factor" where many Romanians expect their salaries to rise (in euro terms) to West European levels.

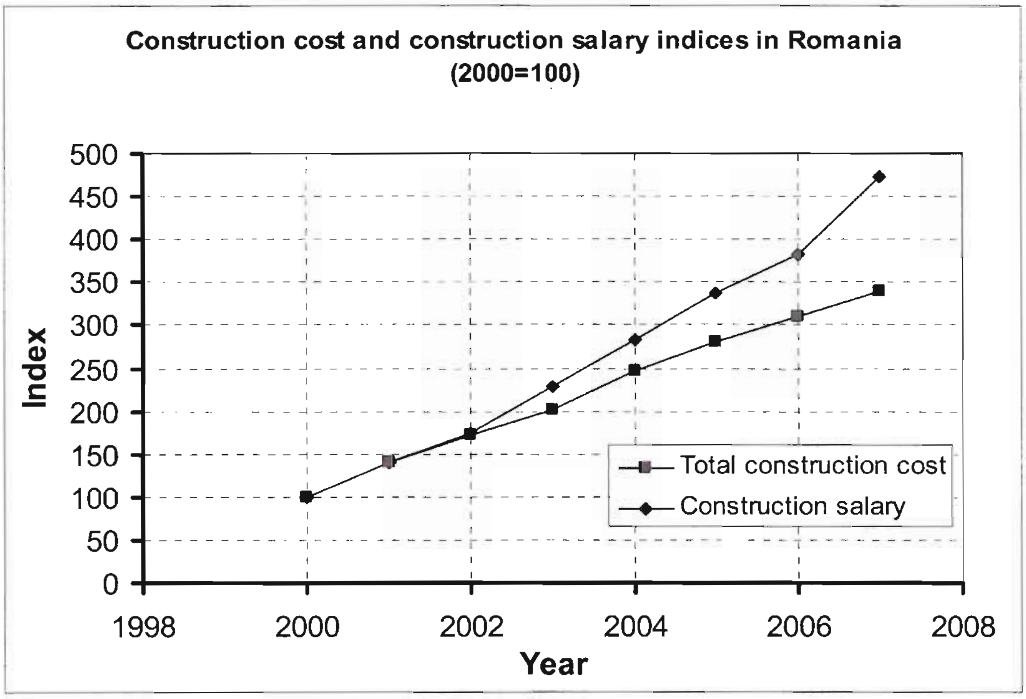
2.3.1.2 Labour costs

According to respondents there is a significant shortage of appropriately skilled labour (particularly technical and managerial staff) in Romania. This has led to wage inflation in some key construction labour categories.

Labour can be supplemented with foreign workers, typically foreign labour comes form Turkey.

Figure 2.2 shows a comparison of indices for total construction costs and for average net nominal monthly salary earnings in the construction industry over the period 2000 to 2007 (data was not available for 2008).

Figure 2.2:



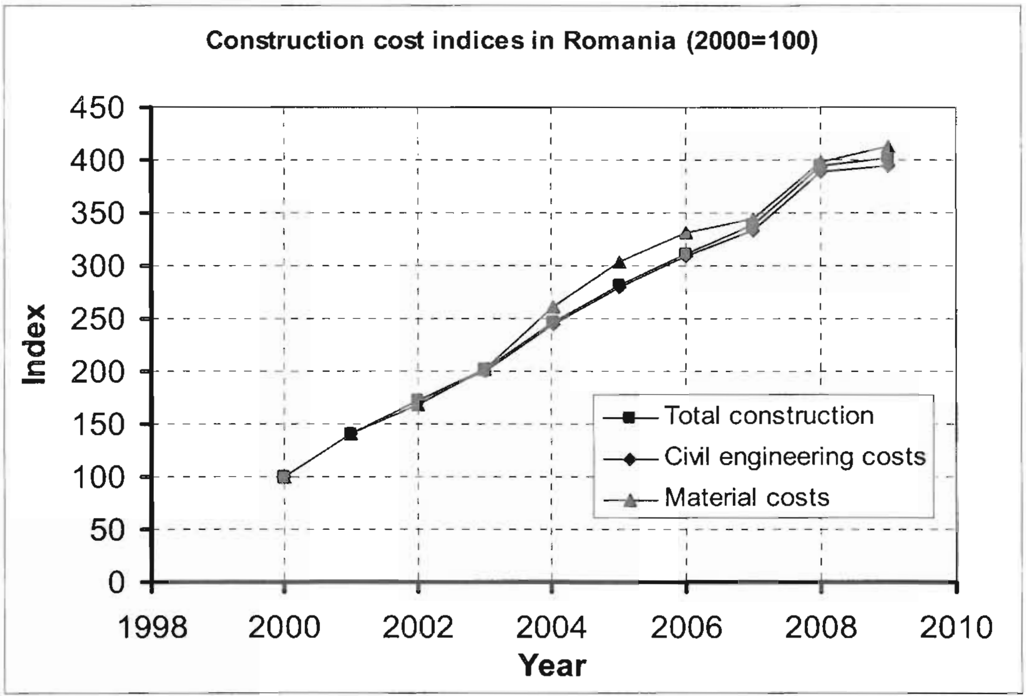
Source: National Institute of Statistics

This shows that since 2002, salaries in the construction industry have been increasing at a much higher rate than overall construction costs. Salary inflation has been very high, with salaries in 2007 almost 5 times greater than those in 2000.

2.3.1.3 Cost of materials

Figure 2.3 below shows a comparison of the construction cost indices for total construction costs, material costs and civil engineering costs in Romania.

Figure 2.3:



Source: National Institute of Statistics. (Figure shown for 2009 are up to July only).

All three measures of construction inflation (total construction costs, material costs and civil engineering costs) show remarkable consistency. The impact of material cost inflation appears substantial according to the data.

Generally inflation has been running at between 5-8% over the last five years, however there has been relatively high levels of cost inflation in some construction materials, in particular steel.

2.3.1.4 Profit margins

No information.

2.3.2 Market dynamics and competitiveness

2.3.2.1 Historical overview: Construction as a whole

The construction market in Romania is estimated to be worth in the region of €10.2 billion in 2008 and provide employment for approximately half a million workers. The infrastructure sub-sector is the second largest construction sector, representing 35% of the total market, with estimated output of €3.6 billion.

The market has been very dynamic over the last five years and although growth is expected to be subdued in the immediate future the construction sector is expected to remain a relatively important contributor to the Romanian economy.

2.3.2.2 Historical overview: roads sector

Romania has a road network of 80,000km of public roads, of which 15,983km are national roads which are run by the National Company of Motorways and National Roads. Presently Romania has approximately 300km of motorways.

Motorways projects which were currently in progress in 2009 are sections of the Bucharest – Ploiesti, Brasov – Bors, Bucharest – Constanta and Arad – Timisoara motorways, totalling almost 263km. These projects are all expected to be completed in 2010 and 2011, almost doubling the length of the Romanian motorway network.

A substantial road rehabilitation programme took place in several phases between 1993 and 2007 but maintenance issues still remain.

Romania's Ministry of Public Works, Transportation and Housing has drawn up a plan for the improvement and modernisation of the Romanian road and rail infrastructure. The objectives for the next ten years include the upgrading of 5,600km of national roads to European class roads, the modernisation of another 1,550km of national roads (valued at €3.7bn) with government municipalities funding, and the continuation of Romania's motorway building programme (valued at €4.7bn).

The breakdown of spending on Romania's roads in 2008 is shown in Table 2.1.

Table 2.1: Total spend on roads 2008 (million Euro)

	Million Euro	
Maintenance - Total	402.4	
Maintenance - Government contribution		388.4
Maintenance - IFI		14.1
Capital repairs - Government contribution	87.2	
New Works (Motorways and Roads Rehabilitation) - Total	1,118.1	
New Works - Government contribution		951.1
New Works - Foreign Funding		167.0
Calamities Works - Total	91.9	
Calamities Works - Government contribution		34.1
Calamities Works - IFI		57.8
Total Government		1,460.8
Total Foreign		238.8
Total		1,699.6

In 2008, over 85% of funding for the roads came from the Government. Spending on new works made up two thirds of the budget.

Since 2005, spending on new works has increased by two thirds, whilst maintenance spending has dropped as shown in Table 2.2.

Table 2.2: Historic spend on roads (million Euro)

	2005	2006	2007	2008
Maintenance	562.1	308.3	362.0	402.4
New Works	548.4	786.4	778.0	926.2

2.3.2.3 Road sector: Competition for contracts

Competition is different between types of road projects (either new road or rehabilitation).

Typically for modernisation projects there are around 14 bidders, comprising local, Greek, Turkish, Italian and German firms.

For new projects bidders are predominantly foreign firms (both Greek and Turkish contractors) while local firms undertake the modernisation/ rehabilitation projects. However, it should be noted that local firms often act as sub-contractors to the foreign firms.

Major foreign contractors over the past five years are shown below by their country of origin:

France	Colas
Italy	Astaldi, Pizzaroti/Tirrena Scavi, Secol, Todini, Grassetto/Itiniera
Spain	FCC
Germany	Max Bogl, Geiger
Israel	Roichmann Bros/ Ashtrom
Greece	Aktor, Mochlos, Efklidis, Proodeftiki, Athena, Pantechniki
Austria	Strabag, Porr
Portugal	Lena, Adriano

Astaldi, Tirrena Scavi, and Colas have been in the Romanian market for at least 15 years and have now taken very large orders. In Astaldi's case they may have orders currently worth in excess of €750 million. Others, such as FCC, Roichmann and Strabag have been in the market for between 5 to 10 years. FCC also have substantial orders. These companies show that it is possible for foreign contractors to be successful in Romania.

Porr and Adriano are new arrivals to Romania, generally there has been little increase in numbers over the past five years. Some other new foreign contractors, such as Impregilo of Italy and Terna of Greece, have tendered for work although not with much success.

Todini recently left Romania and are pursuing RNCMNR in arbitration. Secol left some 3 years ago and are also in arbitration. Proodeftiki and Efklidis ran into severe financial trouble due to the failure of the Greek government to make timely payments for the Olympic Games work. This weakened the companies to such an extent that some of their contracts were terminated for non-performance. Their departure from the market is therefore unconnected to local issues.

Foreign contractors tend not to compete for maintenance work but do undertake small road rehabilitation contracts in the range of €5 – 15 million.

The large Romanian companies that existed prior to 1989 have all but disappeared. The last major contractor, CCCF, still operates but is in financial administration.

The last 5 years or so has seen start-up companies expanding very quickly into the roads market. On larger projects they sometimes joint-venture (with other local contractors) in order to qualify although they prefer to tender as sole contractors where they can.

There have been few foreign/local JVs in contracting. A long-running one, between Colas and SCCF Iasi, led recently to the acquisition of SCCF by Colas.

Overall there is a lack of competition which contributes to high costs. Given the size of the Romanian market and the size of some of the projects there should be many more foreign contractors and many more big-name contractors. Foreign companies are deterred from entering the Romanian market by the perception that corruption exists, by an unstable political scene, and by a fast-changing and convoluted legislative framework.

2.3.2.4 Road sector design and management

We were advised that there is a significant lack of government expertise in construction management which it was suggested can lead to problems with cost estimating, value engineering and risk management on projects.

There is an ever declining standard of project preparation (designs, tender documents, contractor selection) and very poor levels of construction supervision which impacts on the overall construction cost.

Document and implementation standards have fallen over recent years in Romania. Up to about 5 years ago the roads administration, although not adequately staffed with enough people or with properly trained people, was at least stable and had a modest-sized roads programme. From 2004 onwards there was an exodus of the best staff to the booming private sector and this coincided with a crisis in public administration and a large expansion in the roads programme. With ever-changing governments and senior managers and with low salaries, an expanding workload, and poor leadership, the staff that remained tended to be the less experienced and the less motivated. Even when more experienced staff are recruited, there are difficulties retaining staff. This subject has been widely discussed, in particular in recent EU and EIB reports.

There is a glaring shortage of qualified staff in both consultancy firms and public roads administration. There are not enough engineers in Romania and there are not enough with appropriate levels of experience and training (say with between 5 and 20 years experience). There is a very low number with large project experience on FIDIC-type projects.

Political decisions have led to the tendering of immature projects that has driven up overall project costs. This is combined with a tradition, amongst the local consulting fraternity, to tender projects with preliminary designs only and for contractors to perform much of the ground investigation and detailed design.

Detailed design tasks are routinely delegated to contractors under Red Book contracts. Whilst the Roads Authority obtains the project design (known as the "Technical Project") for the tender with contractors required to develop the construction drawings (known as "Working Drawings" or "Execution Details"), the Technical Project is often inadequate This inflates construction costs and some contractors manipulate designs and quantities.

There seems to be a trend to award services and works contracts to local firms only. Services contracts are now awarded more on price than on technical experience. This is leading to even lower levels of design and supervision services.

There are issues over the management of the project "pipeline". Projects tend to come in spates and will follow events such as the signing of a new loan agreement, a funding deadline, or a political decision. Given current restraints on spending it is likely that the pipeline will dry up in 2 to 3 years. There is a lack of long term planning of projects.

2.3.3 Procurement Methods and strategy; lot size

English was used in tender documents up until the last year or so. Romanian is now widely used and whilst there are some contracts in Romanian with an English translation, it is very few. This could be an issue which deters foreign firms from the market.

The trend in Romania is towards larger lot sizes as they are short of administrative staff and want a lower number of contracts. Contractors have also lobbied hard for larger contracts.

2.3.4 Contract types and risk allocation

2.3.4.1 Contract types

Prior to Accession in 2007, nearly all major works were funded by external sources and were generally procured exclusively with the Red Book. Although the Red Book remains the most commonly used form there are now other forms available. About 2 years ago the FIDIC Red and Yellow Books were translated and written into Romanian law as being mandatory. This law was repealed about one year ago and public agencies are now free to use these or other forms of contract. There is also a design-build contract loosely based on the FIDIC Orange Book, although it is not as comprehensive as the FIDIC form.

Where works are funded from external sources, typically FIDIC Red Book and recently the Yellow Book are used for both rehabilitation and new works.

When used in Romania the FIDIC contracts are routinely modified to restrict the authority of the Engineer to determine extensions of time, claims and variations. This causes a bottleneck as the Employer (RNCMNR) is often reluctant (or incapable) to make decisions involving additional payment. The result is sometimes delay, works suspensions, further claims and conflict.

Although tender and contract documents are weak and contractors generally make meritorious claims, RNCMNR always sees the contractors as being at fault and routinely builds into the contracts onerous penalties, (in addition to liquidated damages). This may lead to higher tender prices.

Red Book contracts can also place significant design obligations on the contractor.

The Yellow Book has been used on Arad Bypass motorway, Constanta Bypass motorway, Cernavoda – Constanta Motorway and Roads Rehabilitation VI (multiple contracts). All were tendered in 2008, in English-language, with very little work performed to date. These projects are mainly EIB-funded with Constanta Bypass funded by EBRD. It is not possible to assess Yellow Book contract prices compared with Red Book as no Red Book motorway contracts have been tendered in recent years. Yellow Book contracts did however come in much lower than expected (by 5-6 million Euro per km), probably due to fierce competition and contractor ignorance over risk-pricing.

A modified FIDIC Orange Book has been used on the €3 billion "Bechtel" motorway. This was directly awarded in 2004 and is barely 20% complete.

RNCMNR will shortly launch the Nadlac – Arad motorway as Yellow Book. This is to be funded through EU cohesion funds. In 2010 it is also planned for RNCMNR to make further funding applications for the Lugoj – Deva and Timisoara – Lugoj motorways which would be Yellow Book.

These projects have not yet progressed far enough to know if Yellow Book will lead to higher or lower outturn costs and results are still some years away. The Yellow Book is favoured by politicians as they think it shortens the project cycle and also favoured by RNCMNR since they seem unable to extract quality Red Book designs from consulting firms and are fed up with time and cost overruns and disputes. RNCMNR is short of staff to check designs/ tender documents and to control design consultants and Yellow Book will move this task to contractors.

The FIDIC Pink Book is not used in Romania. For EU grants, their PRAG contracts have always used the FIDIC Red Book. Some smaller World Bank contracts have used the World Bank short form of contract (similar to the NEC).

During the 2000 – 2004 government several projects (at least 10) were being prepared as Private Public Partnerships (PPPs). In 2005, the new government cancelled all of these on the recommendation of a World Bank report. One of the main reasons was the inadequate legal framework existing at that time. The legal framework has been changed and the Comarnic – Brasov motorway project has been promoted as a PPP and an agreement has been signed with the French consortium, Vinci, though financial closing has not yet taken place. Construction costs are estimated at about €1.5 billion and the concession is for 30 years

2.3.4.2 Use of price indices

A Cl. 13.8 indices-based formula has always been used on IFI and State-financed work. It utilises price indices, usually for a basket of 6 or 7 items, from the Romanian Statistical Institute.

ISPA and PHARE-financed projects never included a price escalation formula since the EU insisted upon a so-called fixed price contract.

2.3.5 Other factors: Legal issues

There is an increased awareness on the part of contractors to make claims, which contributes to cost increases.

Romanian law favours utility owners and not project developers. Utility owners are often unaware as to where their infrastructure is and the condition of it. All utility design and relocation work in Romania must be performed by authorised contractors. The cost of utility diversion work has escalated sharply in recent years as utility owners insist upon betterment and require dedicated land to house their infrastructure. This is all at the expense of RNCMNR. Much of the utility identification, design, and diversionary works are done by contractors under provisional sums. The authorised subcontractors may operate a cartel to inflate prices. The utility issue has often led to delays and claims.

Land expropriation is a difficult and time-consuming process in Romania. Land ownership has become highly confused by the confiscation of land by the communist regime and its haphazard return to the original owners. Often land is owned by many parties (being the descendants of the original owner) and sometimes land registry documents do not exist. Projects go to tender with parts of the sites not available. This leads to stoppages, claims and escalating costs.

2.4 Factors influencing construction cost increases: rail sector

2.4.1 Rail construction market overview[1]

World Bank estimates that the railway network in Romania comprised 22,298 kilometres of track in 2004, which would make it the fourth largest railroad network in Europe. Recently, the railway transport sector experienced a dramatic fall in freight and passenger volumes from the peak volumes recorded in 1989 mainly due to competition from road transport. In 2004, the railways carried 8.64 billion passenger-km in 99 million passenger journeys, and 73 million metric tonnes, or 17 billion ton-km of freight. The combined total transportation by rail constituted around 45% of all passenger and freight movement in the country.

The objectives for the next ten years will involve improvement of major rail routes to pan-European corridors.

Spending on the ISPA railway projects, comprising services and rehabilitation works contracts, totalled 66.4 million Euro in 2008.

2.4.2 Rail market contractors

The use of higher technical standards is leading to a reduction in potential bidders, which can be problematic as many Funding agencies require relatively high levels of competition to ensure some level of value for money.

Lack of competition has not presented a particular issue to the railway sector in Romania, but the railway field does not offer a high competition among contractors due to their narrower specialisation and market dependency.

For rail infrastructure projects the market is dominated by international firms.

The major foreign contractors and their areas of work are shown below.

ISPA Railway Projects – supervision, feasibility studies and technical projects	
DE-Consult	Germany
TRANSURB and TUC Rail	Belgium
ITALFFER	Italy (in consortium with Scott Wilson (UK), Obermeyer (Germany) and Tecnic (Italy))
ISPA Railway Projects – works contracts	
TERNA S.A.	Greece
AMEC SPIE (now COLAS Rail)	France
ASTALDI S.p.A.	Italy
KLERCHOS G. ROUTSIS SA - K KOURTIDIS	Greece
SIEMENS AG	Germany
ANSALDO	Italy
PORR	Austria
KASSECKER & BILFINGER BERGER	Austria and Germany
Non-ISPA Railway Projects (EIB, JICA and State budget) – feasibility studies, technical	

design and tender documents	
POYRY	Germany
Non-ISPA Railway Projects (EIB, JICA and State budget) – works contracts	
JV SWIETELSKY	Austria
WIEBE	Germany
TAKENAKA	Japan
JV LEONHARD WEISS	Germany
TAISEI	Japan
HEITKAMP	Germany
JV THALES	France
BALFOUR BEATTY	Germany

Generally, local contractors have joined together to become larger single firms. They are also acting as sub-contractors to larger firms and are forming joint ventures with larger firms, both foreign and local. Some local contractors have been successful in being awarded contracts. These include ARCADA and CONCEFA for ISPA works contracts and THALES for Non-ISPA works contracts.

Foreign contractors are interested in contracts of all sizes, ranging from 3 to 139 million Euro for rehabilitation works. There is also interest for smaller new works contracts.

There are mixed degrees of success for foreign contractors. Whilst some are successful, the reasons for others not being successful are felt to be the contractors coming in at too high a price, occasionally tender prices which are too low, and insufficient railway experience and expertise (where large construction companies have their main experience in other types of works). It has been a trend in recent years for large contractors in other construction areas to enter the railway construction market, sometimes after incorporating specialised rail constructors into their companies.

Routine maintenance is carried out by a subsidiary fully owned by the Rail Infrastructure Manager, CFR-SA.

2.4.3 Cost Indices

Respondents reported that the main inflation indicators (i.e. CPI/RPI) of inflation are generally lower than any construction inflation.

2.4.4 Factors influencing cost development

We were advised that there have been very large increases in the price of construction materials and wage costs over the last few years that have directly affected the outturn cost of some rail projects. Against this background, respondents were keen to have rail sector construction cost indices made available by the NSO.

Romania is a seismic area, changes in Romanian building standards in 2007 led to some cost increases on projects that were already underway.

Following the tender process the price estimates tend to decline through competition – most problems arise after contract through claims, this is possibly the result of selecting the lowest bidder.

As works at present in Romania are modernisation and rehabilitation, it is difficult to compare unit costs on projects over time as the costs depend on so many factors, such as the condition of the infrastructure when the works began and the technical specification.

Shortages of experienced professional staff in both consultancies and rail administration have contributed to construction cost increases. Engineering design is of low quality and the overall management of all lots over a section by FIDIC Engineers is rather weak. The Rail Infrastructure Manager is underfinanced, which impacts on the ability to manage projects and contracts.

Procurement rules also affect construction costs. The rules do not prevent the acceptance of tenderers submitting financial proposals far below current market prices. Low and irresponsible bids can be rejected although evaluation committees are often too timid and too inexperienced to do so, leading to diminishing quality. Strong and effective supervision is needed to control low-bidding contractors or any other contractors who fail to perform. This is down to the quality and experience of the supervision staff, whilst clients need to learn to make prompt and difficult decisions in these situations.

2.4.4.1 Lot size

The current approach in the Romanian railway sector is for separate works contracts based on specialities for each section of railway, for instance bridges and culverts works, infrastructure and superstructure works, civil works in the stations. It is intended to change this approach to have a single main contractor for each section of railway.

Using lots by speciality resulted in slightly increased competition per lot. However, with different types of works along the same railway section, unexpected overlaps were found between lots, resulting in a negative impact on project duration and costs. A greater number of lots also require more management resources, which is difficult in the light of staff shortages.

2.4.4.2 Contract types

The standard form of contract used for railway works is FIDIC Red or Yellow book both for projects funded from national resources and for those funded through EU grants. Tender documents are published only in Romanian. It is not felt that the use of Romanian has discouraged foreign firms from tendering. However, few will tender and supply services in Romanian.

FIDIC Yellow book is to be used on the project “Operational pilot project for an ETCS/ ERTMS level 2 application” which will be launched in June 2010.

2.4.4.3 Risk allocation

Contingencies of 5% of the works price were included in ongoing EU funded FIDIC contracts. However, since early 2008 a Romanian law introduced an increased contingency value of 10% which will be used in future contracts.

2.5 Potential Impact of target level of construction in the Operational Programme (Transport) to 2013

2.5.1 Historic level of activity

The level of spending and allocation of funds to date under priority axis 1 and 2 of the Operational Programme is shown in Table 2.4.

Table 2.4: Operational Programme (Transport) spending and funds allocated (million Euro)

	Contracted	Under evaluation - European Commission	Under evaluation - AMPOST	Total contracted or under evaluation	Allocated under POST	Remaining as available funds
Priority axis 1 - modernisation and development of TEN-T priority axes aiming at sustainable transport system integrated with EU transport networks	123.6	160.6	1,054.4	1,338.6	1,573.1	234.5
Priority axis 2 - modernisation and development of the national transport infrastructure outside the TEN-T priority axes aiming at sustainable national transport system	25.0	153.9	215.4	394.3	381.8	12.5

Whilst the value of projects which have been contracted is relatively low in comparison to the total funds allocated, there is a high value of projects which are currently under evaluation. Projects currently under evaluation include the construction of the Arad – Timisoara motorway and Arad bypass, the construction of the Orastie – Sibiu motorway and the construction of the Nadlac – Arad motorway.

2.5.2 Future activity and implications of the OP investment program

In the next few years Romania will receive funds totalling almost €20 billion from the European Union that will have a significant impact on the construction industry, a sector historically experiencing increased levels of activity. Below we outline the likely impact on labour, equipment and material inflation in the construction industry in Romania in the near future.

2.5.2.1 Labour

Difficulty in obtaining adequate labour has been an issue in the Romanian construction industry since EU membership, as many construction workers have sought work in other EU member states. However, this position is likely to ease in the immediate future as construction markets across Europe stagnate or decline, resulting in increases in the availability of labour and a subsequent reduction in construction labour wage rates throughout Romania.

2.5.2.2 Equipment

The majority of companies lease their construction equipment and transport in Romania. Given that the value and number of contracts in Romania is expected to decline significantly through 2009 and beyond, with any recovery unlikely before 2012, we expect there to be significant decreases in the cost of leasing construction equipment and transport going forward.

2.5.2.3 Materials

With the construction market in Romania likely to continue declining through 2009, building material costs are expected to moderate in line with demand.

2.5.3 Impact of the OP Transport

Spending in the roads sector is expected to increase significantly in 2009 and 2010 compared with 2008 levels. The breakdown of anticipated expenditure is shown in Table 2.5 below.

Table 2.5: Anticipated expenditure on roads (million Euro)

	2009	2010
Maintenance - Total	577.5	489.1
Maintenance - Government contribution	560.0	471.2
Maintenance - IFI	17.5	17.9
Capital repairs - Government contribution	41.0	119.0
New Works (Motorways and Roads Rehabilitation) - Total	1,411.6	2,460.8
New Works - Government contribution	1,017.4	1,750.6
New Works - Foreign Funding	394.1	710.3
ERDF+Cohesion Funds+ITHACA[2] Projects - Total	228.2	184.0
Calamities Works - Total	83.8	172.0
Calamities Works - Government contribution	27.8	46.4
Calamities Works - IFI	56.0	125.5
Total Government	1,646.2	2,387.3
Total Foreign	695.8	1,037.7
Total	2,342.0	3,424.9

Foreign funding will increase significantly from 2008 levels, with investment in 2009 of almost three times that seen in 2008 and in 2010 of more than four times 2008 levels. Government funding will also increase year on year although not to such a large extent. In particular spending on new works will increase.

The current five year plan for the road sector shows a peak in spending in 2011 and 2012

Table 2.6: Five year plan for road sector (million Euro)

	2009	2010	2011	2012	2013
Total expenses (all projects)	2,091.8	2,972.7	5,503.8	4,734.2	3,275.0

Note: small differences noted between the totals in this table for 2009 and 2010 and the estimates in Table 2.5. These data are continuously updated

Romania has a large road rehabilitation programme, and by 2012 it is anticipated that over 2000km of rehabilitation will have taken place, quadrupling the work done up to 2009.

Table 2.7: Length of road rehabilitated (km)

Year	2009	2010	2011	2012
Number of finalized km (rehabilitation projects)	537	607	1,539	2,130

There is also a large amount of work planned for the railway sector over the next few years. Spending in the railway sector is expected to increase significantly over the next few years, peaking in 2011 and 2012. Table 2.8 shows forecasts of spending up to 2015.

Table 2.8: Anticipated expenditure on railways (million Euro)

	Total costs	Payments up to end 2008	Remaining payments 2009-2015	2009	2010	2011	2012	2013	2014	2015
SOP-T 2007-2013	3,202.4	2.6	3,199.8	8.5	197.3	836.1	952.0	782.8	412.9	10.3
CF/ERDF	1,826.4	0.0	1,826.4	0.2	106.4	462.6	536.5	441.9	272.0	6.8
IFI loans	302.0	2.0	300.0	5.9	45.0	93.0	96.0	51.1	9.0	0.0
State budget	1,074.0	0.6	1,073.4	2.4	45.9	280.5	319.5	289.8	131.9	3.4

[2] Information Technology Advanced Corridor Applications

ISPA total	805.5	311.2	659.7	328.8	165.4	165.4	0.0	0.0	0.0	0.0
ISPA	399.9	213.8	186.1	186.1	0.0	0.0	0.0	0.0	0.0	0.0
State budget	405.5	97.4	473.5	142.7	165.4	165.4	0.0	0.0	0.0	0.0
IFI total	460.1	25.5	434.6	31.3	106.8	110.7	114.2	60.8	10.7	0.0
IFI loans	380.5	18.6	361.9	25.4	87.4	93.0	96.0	51.1	9.0	0.0
Co-finance IFI loans	79.6	6.9	72.7	6.0	19.4	17.7	18.2	9.7	1.7	0.0
100% State budget	1,564.5	74.4	1,490.1	40.2	267.3	96.9	90.8	129.0	429.2	436.7
Total spend	**6,032.5**	**413.7**	**5,784.2**	**408.8**	**736.9**	**1,209.1**	**1,157.0**	**972.6**	**852.9**	**447.0**

Expenditure on railways in 2011 is forecast to be almost triple that in 2009. ISPA projects, which comprised the majority of spending in 2009, will be completed in 2011 and SOP-T projects account for the majority of spending over the period 2011-2013. By 2015, almost all expenditure is on projects funded entirely through the state budget, with total expenditure much lower, almost returning to 2009 levels.

Major projects over this period are the rehabilitation of the following railway sections;

- Coslariu- Sighisoara (813 million Euro)
- Gurasada – Simeria (720 million Euro)
- Simeria – Coslariu (655 million Euro)
- Curtici – Radna (350 million Euro)

These four projects will rehabilitate a total length of 244km of railway by 2015.

2.6 Conclusions

The Romanian transport sector has encountered many, well documented, problems which have affected the development of the road and rail networks since 2001. The official statistics, which indicate that infrastructure costs have increased significantly faster than consumer prices in general, show only a small part of this picture. Other key conclusions are as follows:

1. there has been a construction boom over the period 2004-2008, leading to price increases. However, an equal part of this story has been that whilst international contractors have entered the market, contractor turnover has been high, with several departing, some with outstanding claims still to be settled;
2. only a few foreign road contractors have become established and there is a lack of competition affecting costs.
3. corruption is still believed to exist and this, coupled with a unstable political environment, a complex legal framework and increasing tendency to advertise in Romanian language continues to deter foreign companies;
4. facets of the rail market are more specialised so that the very nature of the works limits competition for contracts;
5. weaknesses in Employer capacity are a common problem in this sector. These weaknesses affect the quality of management, inter alia, of design, contract award, supervision of works and overall project management.

Against this background of limited management capacity, the prospects and plans for the road and rail networks are substantial. There are, therefore, high returns to be enjoyed if packages can be put in place to implement corrective measures. In summary, the scope of this Study addresses a small but important part of an overall complex picture. Recommendations are given in chapter 7 below.

3 Data Analysis

3.1 Road Sector

3.1.1 Cost development

3.1.1.1 Key assumptions

Ratios have been calculating using the costs at three points on the project timeline as shown in the table below.

Table 3.1: Cost estimate points on time line

Cost estimate	Point on timeline
C1	Point 2 (appraisal) or point 3 (decision to proceed)
C2	Point 8 contract award
C3	Point 10 (opening to traffic) or point 11 (handover of works)

From these costs, three cost development ratios have been estimated as follows. These show the % overrun of costs on the project.

Table 3.2: Cost development ratios

Cost estimate	Point on timeline	Road projects: number of data points for all countries
R1	Ratio (C2-C1)/C1 (cost development from appraisal or decision to proceed to contract award)	98
R2	Ratio (C3-C2)/C2 (cost development from contract award to cost at opening for traffic or final outturn)	95
R3	(C3-C1)/C1: overall cost development ratio.	102

In some cases cost information was not available at all three points on the time line, therefore only one ratio has been calculated in this situation.

For Romania, 8 projects have been included.

Two questions have been addressed in assessing cost development:

- Question A: was the construction cost estimate accurate? and
- Question B: was the loan or grant amount sufficient?

For Question A, the analysis has been conducted at constant prices using the Consumer Price Index as a deflator[3] and the price base of the C1 cost estimate. Contingencies and price adjustments were excluded from the C1 cost.

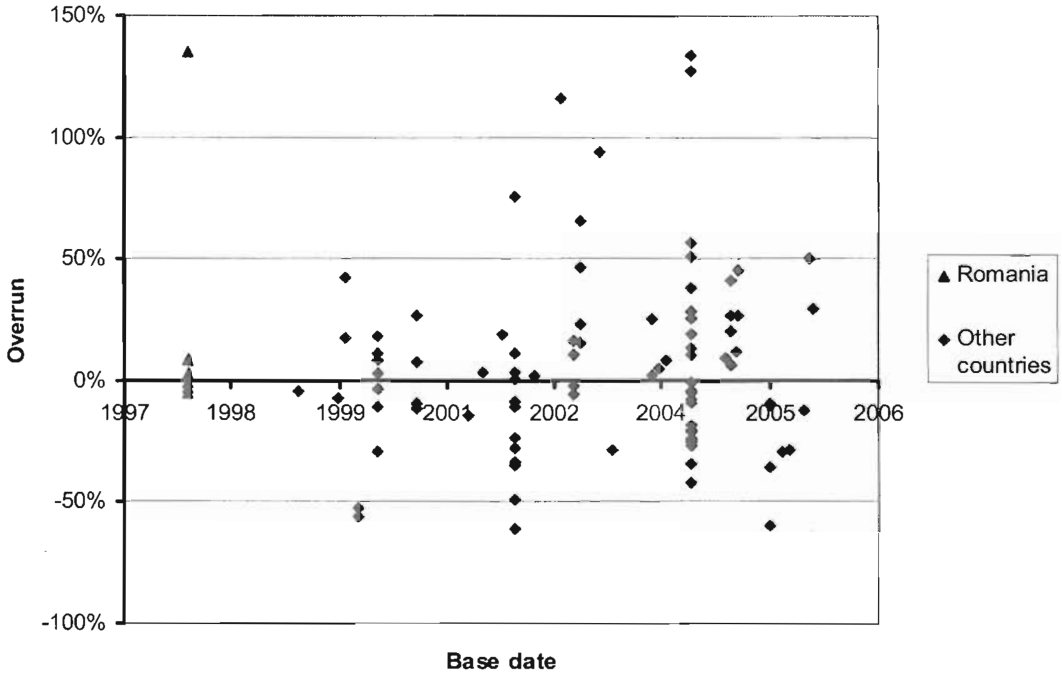
For Question B, the analysis has been conducted at current prices. The C1 costs include contingencies and price adjustments.

3.1.1.2 Results: Question A, was the construction cost estimate accurate?

Figures 3.1 – 3.3 show the R1, R2 and R3 values for Romania against those for the other countries participating in the study. The values are plotted against the base date to which the costs were deflated.

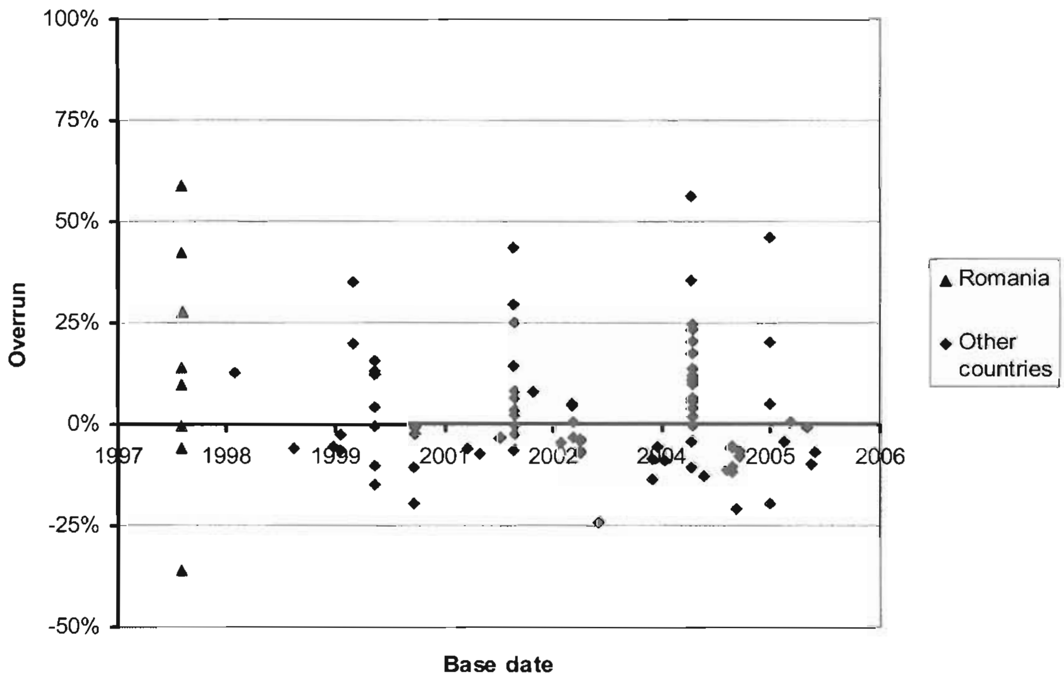
[3] For Romania, due to very high inflation which was not reflected in the changes to the project prices, US Dollar inflation was used. See Task 9 report for further details.

Figure 3.1: R1 values ((C2-C1)/C1)



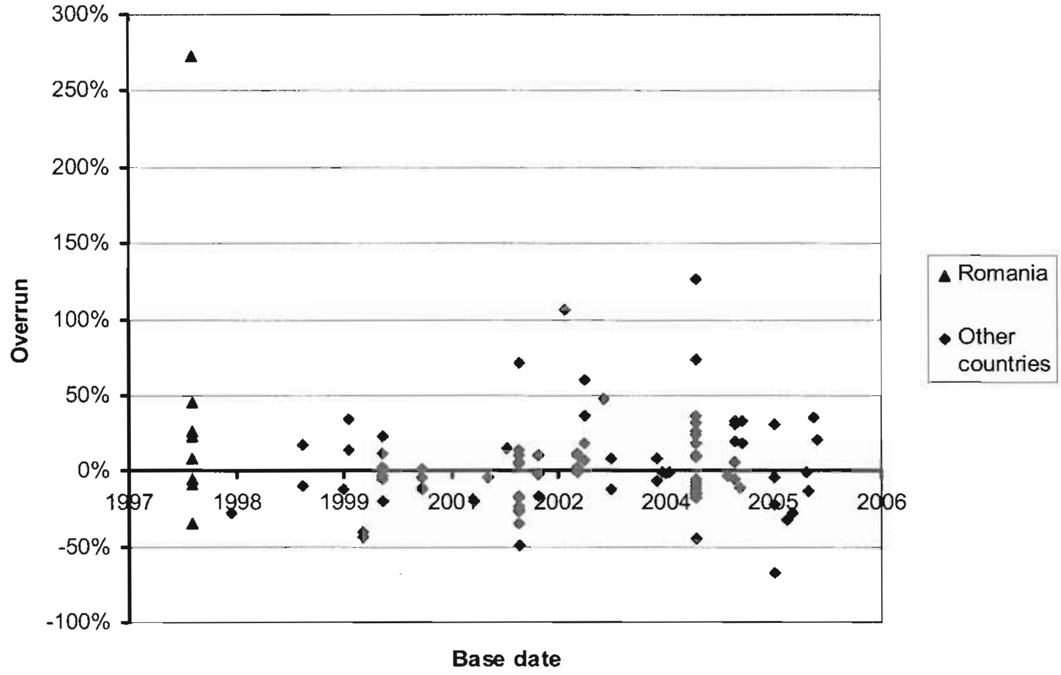
Across the other countries, just over half of projects (52%) had an increase in costs between appraisal and contract award. This was the same in Romania. However, with one exception the overruns or underruns on Romanian projects were very small at this stage in the project cycle. One Romanian project had one of the largest overruns seen, more than doubling the cost estimated at appraisal by contract award.

Figure 3.2: R2 values ((C3-C2)/C2)



However, whilst less than half (46%) of the projects in other countries had a cost overrun between contract award and final outturn cost, in Romania it was almost two thirds of projects. The Romanian projects included some of the largest overruns in cost between contract award and completion and also the largest under run.

Figure 3.3: R3 values ((C3-C1)/C1)

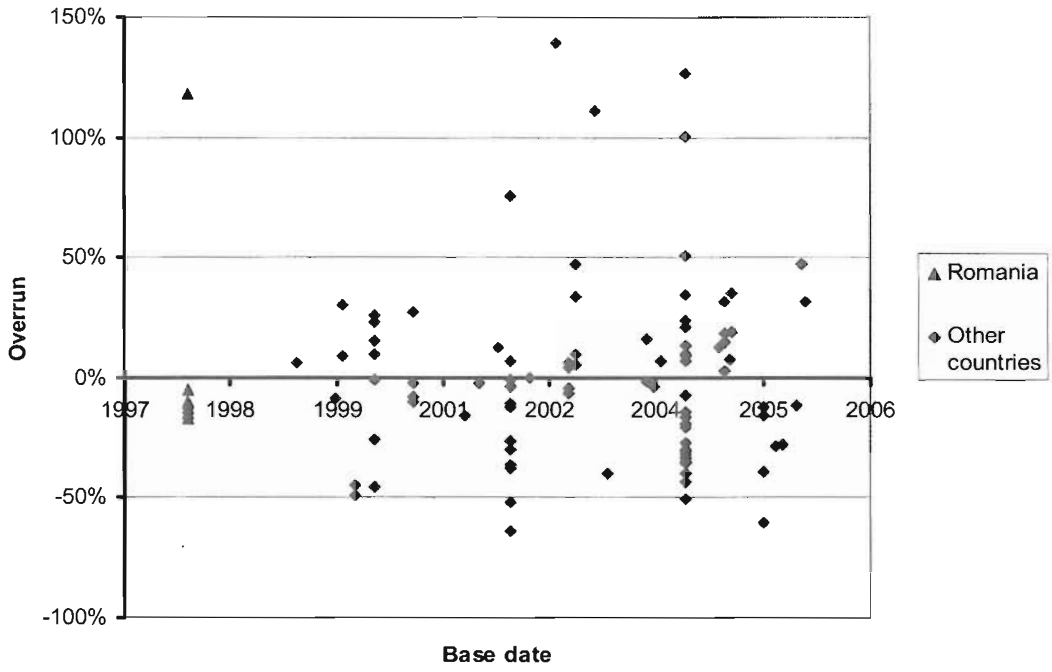


Looking at the overall change in costs from appraisal to final outturn cost, again Romanian project were slightly more likely to overrun than those in other countries (63% of projects overran compared with 48% in other countries). One project in Romania had by far the largest overrun of all projects, with the final cost being almost four times the cost estimated at appraisal.

3.1.1.3 Results: Question B, was the loan or grant amount sufficient?

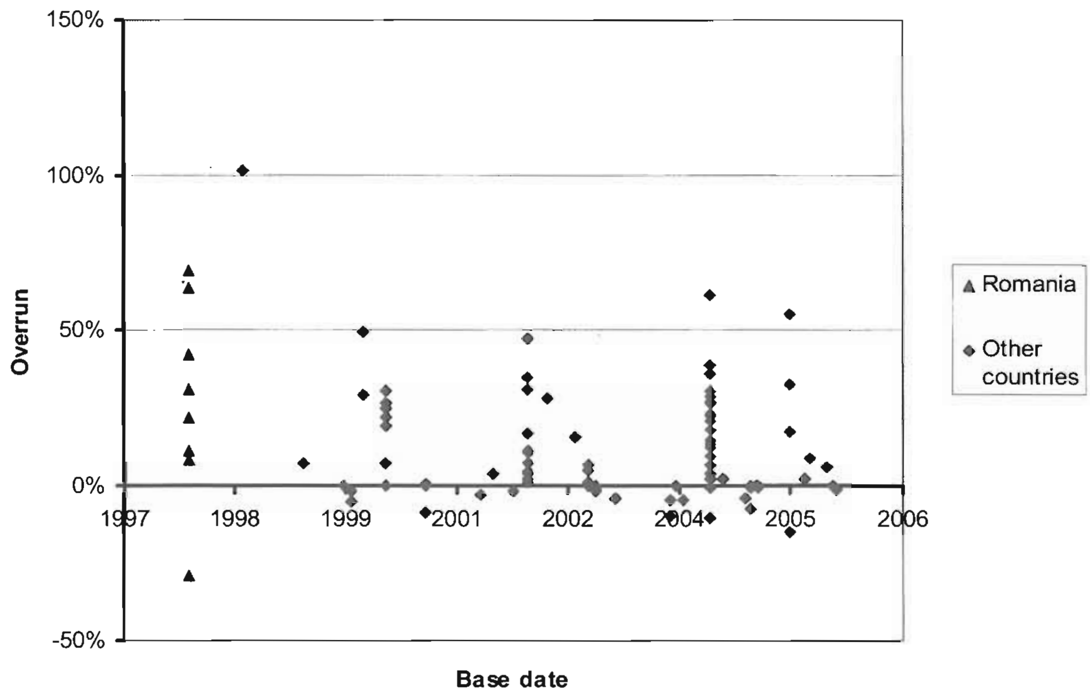
Figures 3.4 – 3.6 show the R1, R2 and R3 values for Romania against those for the other countries participating in the study. The ratios are calculated using the values in current prices. The values are plotted against the base date of the costs at appraisal.

Figure 3.4: R1 values ((C2-C1)/C1)



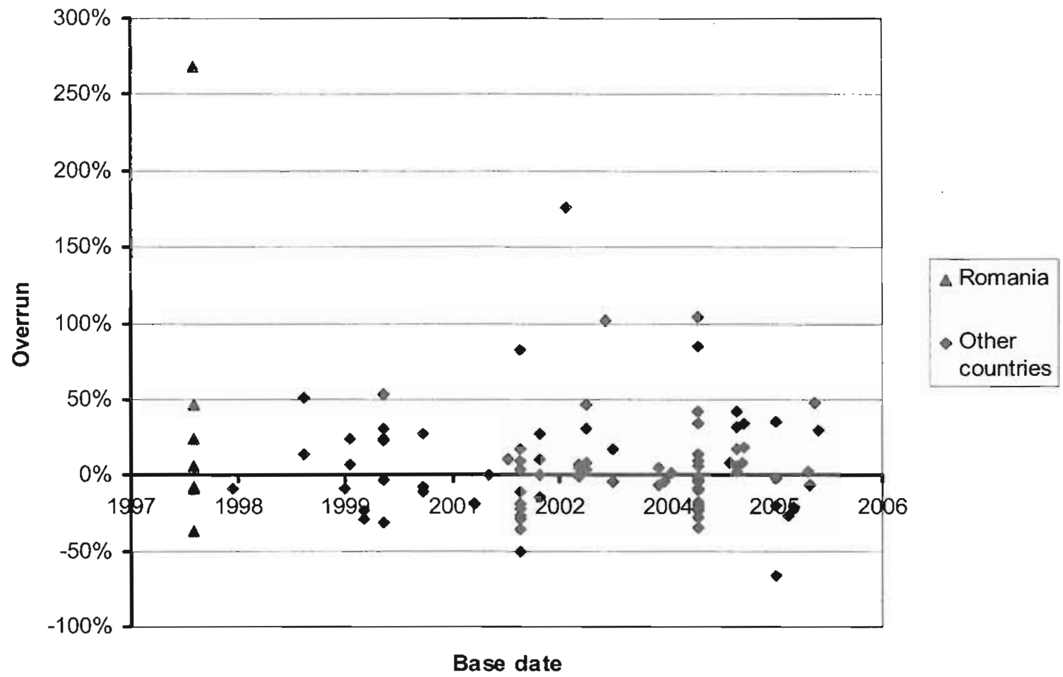
When analysed in current prices, all but one of the Romanian projects reduced in cost from appraisal to contract award. The reductions ranged from 5 to 17%.

Figure 3.5: R2 values ((C3-C2)/C2)



Only one Romanian project did not increase in cost between contract award and project completion. The project showing a decrease had a much larger decrease in cost at this stage than any of the other projects. Most of the overruns seen in Romanian projects were large, with two increasing costs by over half.

Figure 3.6: R3 values ((C3-C1)/C1)



Across the whole project cycle, almost two thirds of Romanian projects increased in cost. One project showed a very large cost increase, whilst three others had cost increases of around a quarter to a half.

3.1.1.4 Summary

Considering the results as a whole, it seems that for projects in Romania cost estimates at appraisal are mainly fairly accurate in comparison to the cost at contract award, but the final outturn costs tend to exceed the contract price resulting in the majority of projects having an overrun across the project cycle.

3.1.2 Cost benchmarking

3.1.2.1 Key assumptions

Projects were broken down into three types:

- New National road – one lane in each direction
- New Motorway or dual carriageway – two lanes in each direction
- National road rehabilitation
  - Light rehabilitation – purely overlay of existing road
  - Medium rehabilitation – overlay of road with further works
  - Full reconstruction – carriageway rebuilt

All of the projects studied in Romania were national road rehabilitation projects.[4]

3.1.2.2 Methodology

In general terms, the methodology has been to collect historic information on final outturn costs. The projects included have been restricted to "standard" projects. That is, ones which did not include a high percentage of structures or involve construction on difficult

[4] It was not possible to include any motorway projects in the analysis as the analysis had to be restricted to "standard" projects in order to have projects that involved similar works to be able to benchmark construction costs. The projects for which information was supplied did not include any "standard" motorway projects.

terrain. It was necessary to restrict the database to "standard" projects in order to have projects that involved similar works to be able to benchmark construction costs. The assessment of whether the project was "standard" was made based on the technical description given of the project. In consequence, a number of projects which could be included in the data base for task 9 (Cost development) were considered unsuitable for cost benchmarking.

In addition, the data received was reviewed to ensure the quality of the data. In some cases the final outturn costs were too uncertain due to the project still being some way from completion, and in some cases the information was felt to be unreliable due to inconsistencies or gaps in the information received. These projects were excluded from the analysis.

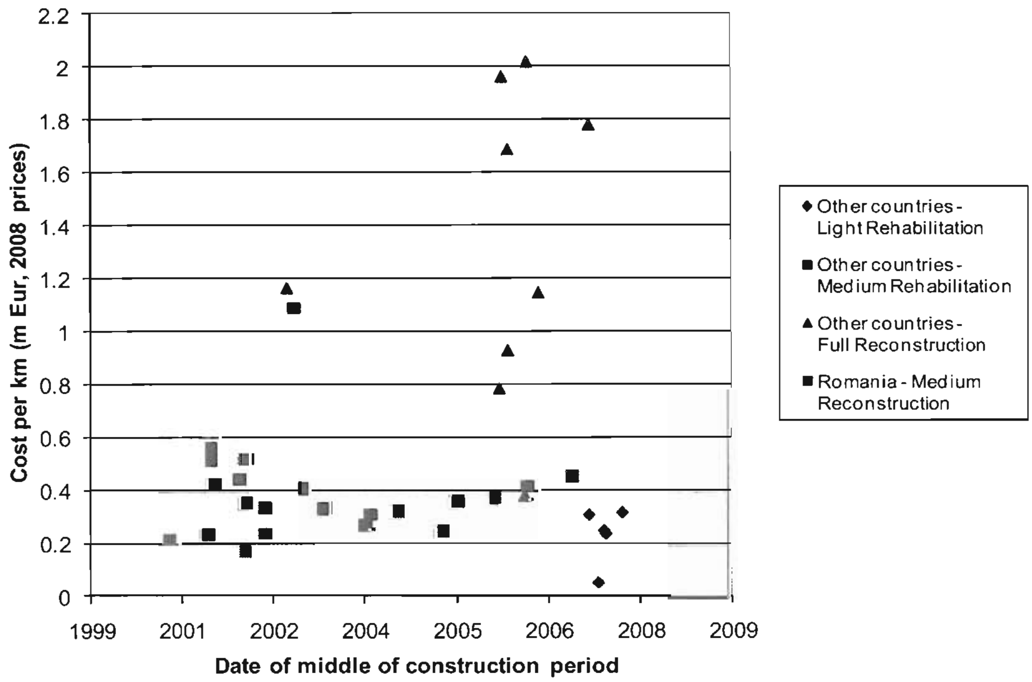
VAT has been excluded from the final outturn cost. The cost used is based on the total cost including land, supervision and design.

The analysis has been conducted at constant prices in order to be able to compare costs between projects constructed over different periods. A price base of 2008 has been chosen in order to produce values for a recent year. The costs supplied were either in local currency or Euro depending on the country and project. Where the costs were in a local currency, these were converted into Euro based on the exchange rate on the date at the midpoint of the construction period. The price base of the outturn cost was taken to be the year of the midpoint of construction and the costs were inflated to 2008 prices using IMF data for average consumer price inflation by country.

3.1.2.3 Results: National Road Rehabilitation

Figure 3.7 shows the unit cost per km for national road rehabilitation in Romania compared with the other participating countries. This category was further disaggregated based on the level of works required. The Romanian projects included were categorised as being medium rehabilitation works.

Figure 3.7: Cost per km of national road rehabilitation (mil EUR, 2008 prices)



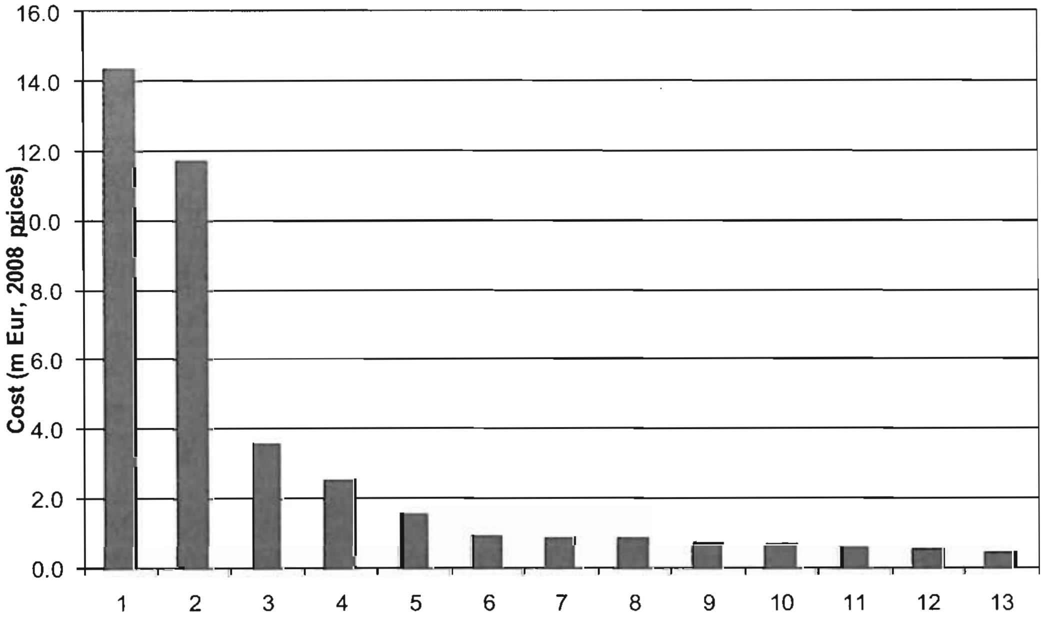
The Romanian projects tended to be the most expensive of the medium rehabilitation projects. This is due in part to the high levels of inflation seen in Romania over recent years.

3.1.2.4 Results: Average unit cost for infrastructure components

An analysis was carried out on the average cost for infrastructure components such as bridges, tunnels and viaducts.

Figure 3.10 shows the unit cost for a bridge for each project where cost information on bridges was supplied across all countries participating in the project.

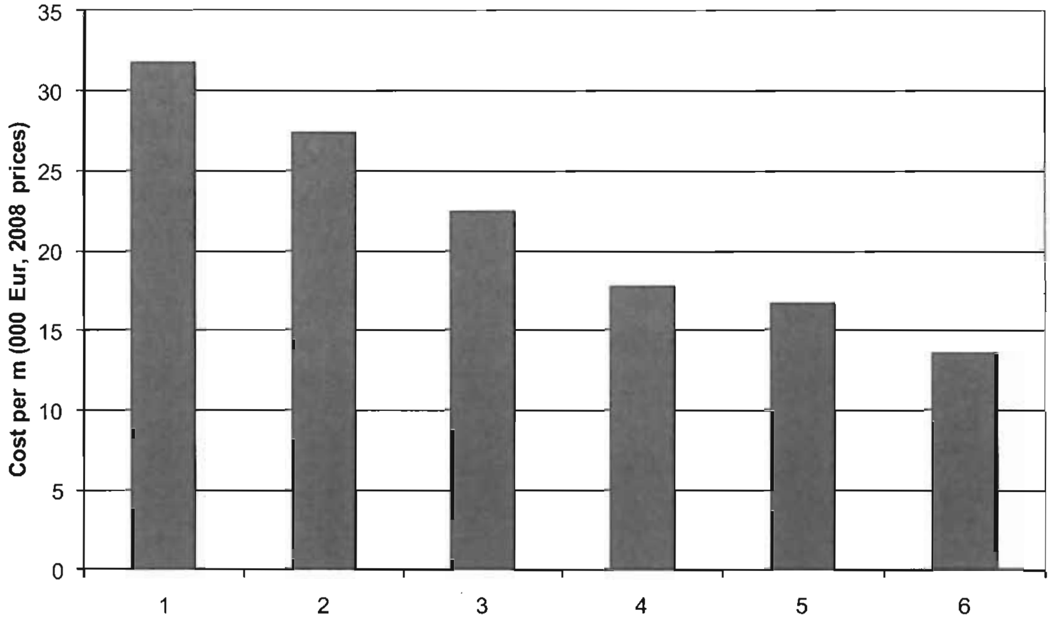
Figure 3.10: Bridge unit cost (mil Eur, 2008 prices)



A wide variation is seen in the unit cost of bridges from around 0.5 to over 14 million Euro at 2008 prices. However, none of these projects were in Romania.

However, this analysis is limited as it does not reflect the varying lengths of the bridges constructed. Whilst this information was not supplied for all projects which included bridges, a further analysis was carried out where this information was available to produce a cost per metre of constructing a bridge. This showed that the two projects which had much higher bridge costs were based on just one longer bridge, whilst the other projects included several shorter bridges, explaining the wide range seen when analysed by the number of bridges. The analysis by length for all countries is shown in Figure 3.11.

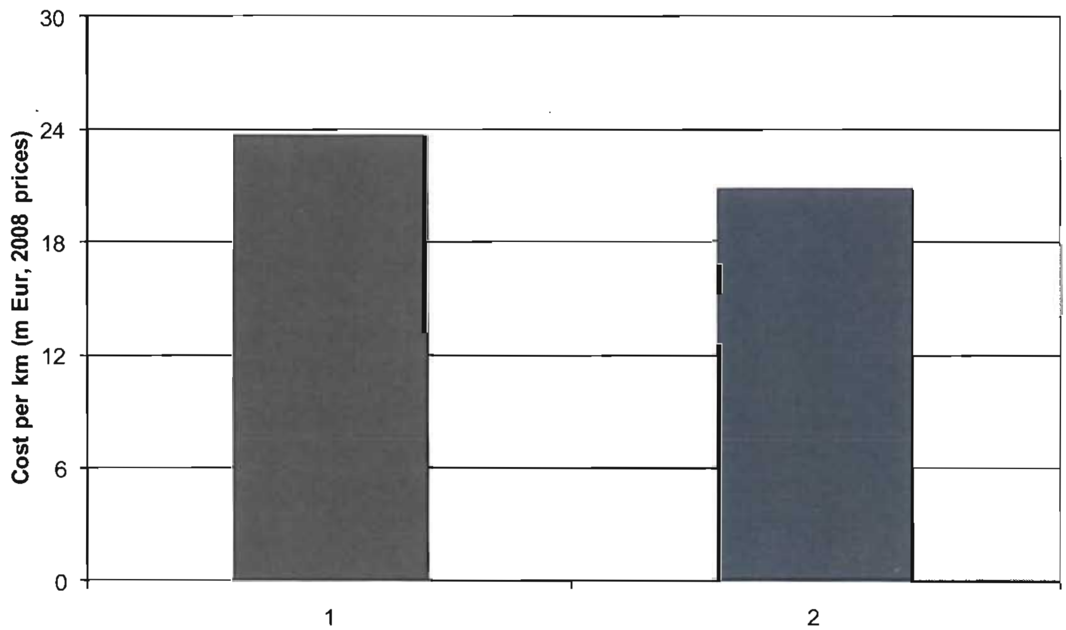
Figure 3.11: Bridge unit cost per metre (000 Eur, 2008 prices)



Although the sample is smaller when the data is analysed on this basis, this shows a narrower range of unit costs for bridges from around 14 to 32 thousand Euro per metre of bridge constructed.

Very limited information was available on the cost of viaducts from the projects included in Task 7. Figure 3.12 shows the viaduct unit costs per kilometre constructed. This did not include any Romanian projects.

Figure 3.12: Viaduct unit cost (mil Eur/km, 2008 prices)



Whilst only two data points were available with viaduct cost data, the unit prices were relatively consistent, giving a range of cost per kilometre in 2008 prices of between 20 and 24 million Euro.

Only one project included in the study (which was not in Romania) provided cost information on a tunnel. This showed a unit cost per kilometre of tunnel constructed in 2008 prices of 25.5 million Euro.

3.1.2.5 Summary

The results from the cost benchmarking for the road sector indicate that compared with the other countries taking part in the study, Romania is one of the more expensive, with the cost of projects mainly at the top end of the ranges observed for rehabilitation projects. This is partly due to Romania's inflation rate, which has been higher in recent years than for the other participating countries.

3.2 Rail Sector

3.2.1 Cost development

Insufficient data was available to make an assessment of cost development in the rail sector.

3.2.2 Cost benchmarking

3.2.2.1 Key assumptions

Projects were broken down into three types:

- Route upgrade (renewal of track, signalling and overhead line equipment)
- Permanent way (track renewal only)
- Signalling

These project types are not mutually exclusive with some projects being included in all three categories where suitable cost breakdowns were available.

Costs are based on the final outturn cost where this information was available. Where, in some cases, the final costs have not been finalised the most up to date estimate of the final cost has been used.

For Romania the projects included in the study included all three categories. The total number of projects analysed was 15 for route upgrade, 17 for permanent way and 16 for signalling, of which three were Romanian.

3.2.2.2 Methodology

In general terms, the methodology has been to collect historic information on final outturn costs. The projects included have been restricted to "standard" projects. That is, ones which include route upgrade or permanent way or signal elements. It was necessary to restrict the database to "standard" projects in order to have projects that involved similar works to be able to benchmark construction costs. The task 7 database for rail comprised a total of 19 projects. A further 8 projects were excluded as they were more specific schemes, including items such as Hot Axle Box Detectors, new reception yards and station upgrades. It was not possible to draw comparisons between these schemes.

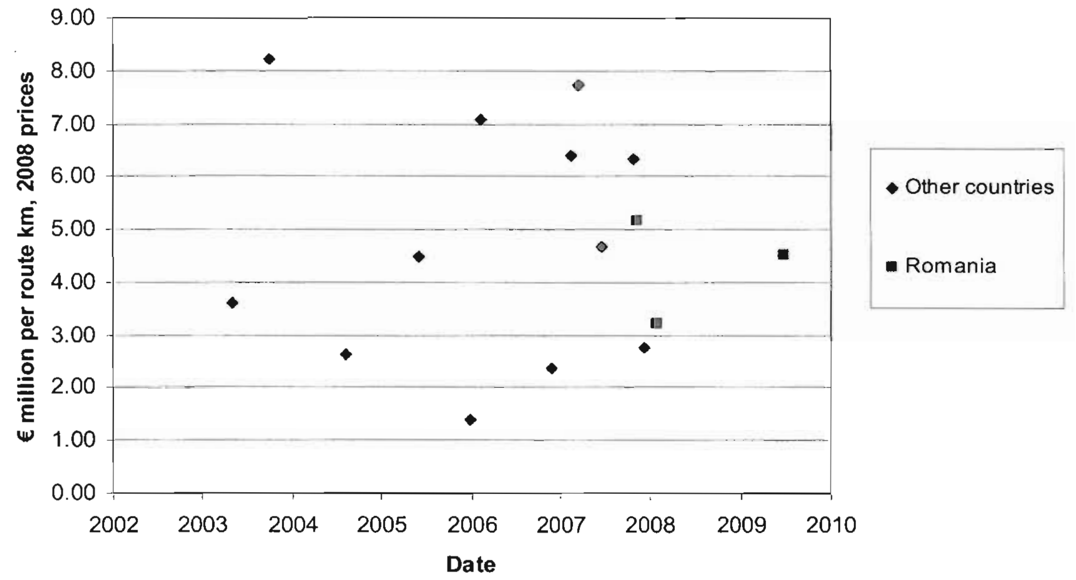
However, even in the projects included, there is insufficient detail in the information provided to be completely confident in the comparability of all of the schemes. Individual schemes vary in scope, for instance some include an element of route diversion to provide for a higher speed capacity.

The analysis has been conducted at constant prices in order to be able to compare costs between projects constructed over different periods. A price base of 2008 has been chosen in order to produce values for a recent year. The costs supplied were either in local currency or Euro depending on the country and project. Where the costs were in a local currency, these were converted into Euro based on the exchange rate on the date at the midpoint of the construction period. The price base of the outturn cost was taken to be the year of the midpoint of construction and the costs were inflated to 2008 prices using IMF data for average consumer price inflation by country.

3.2.2.3 Results: Route upgrade

Figure 3.8 shows the unit cost per route km for route upgrade costs in Romania compared with the other participating countries.

Figure 3.8: Cost per route km of route upgrade (mil EUR, 2008 prices)

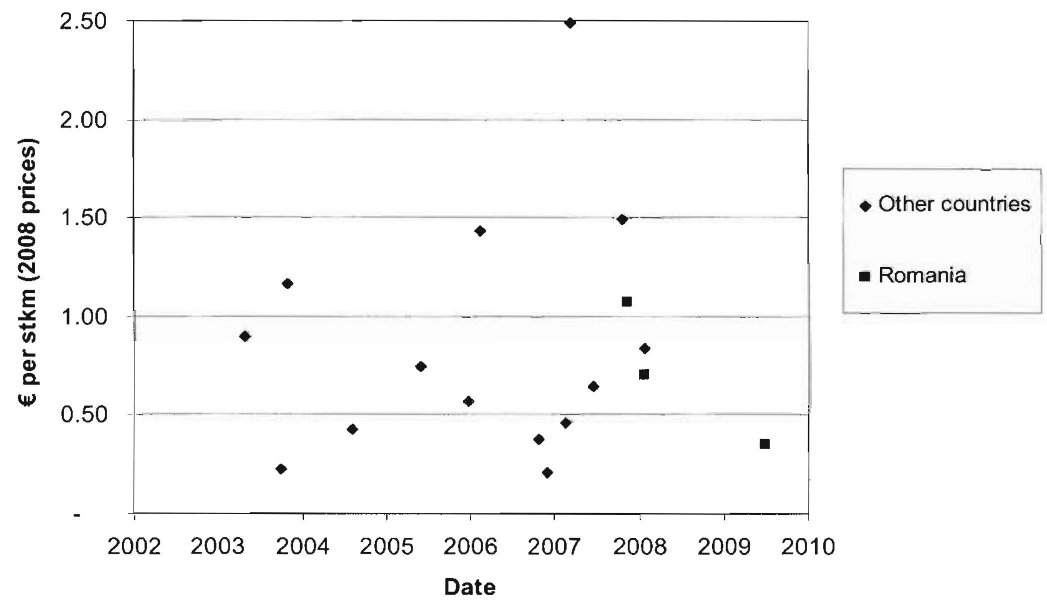


This shows that for route upgrade costs, the unit costs for projects in Romania were in the middle of the range seen across all countries.

3.2.2.4 Results: Permanent way

Figure 3.9 shows the unit cost per single track km for permanent way costs in Romania compared with the other participating countries.

Figure 3.9: Cost per single track km of permanent way (mil EUR, 2008 prices)

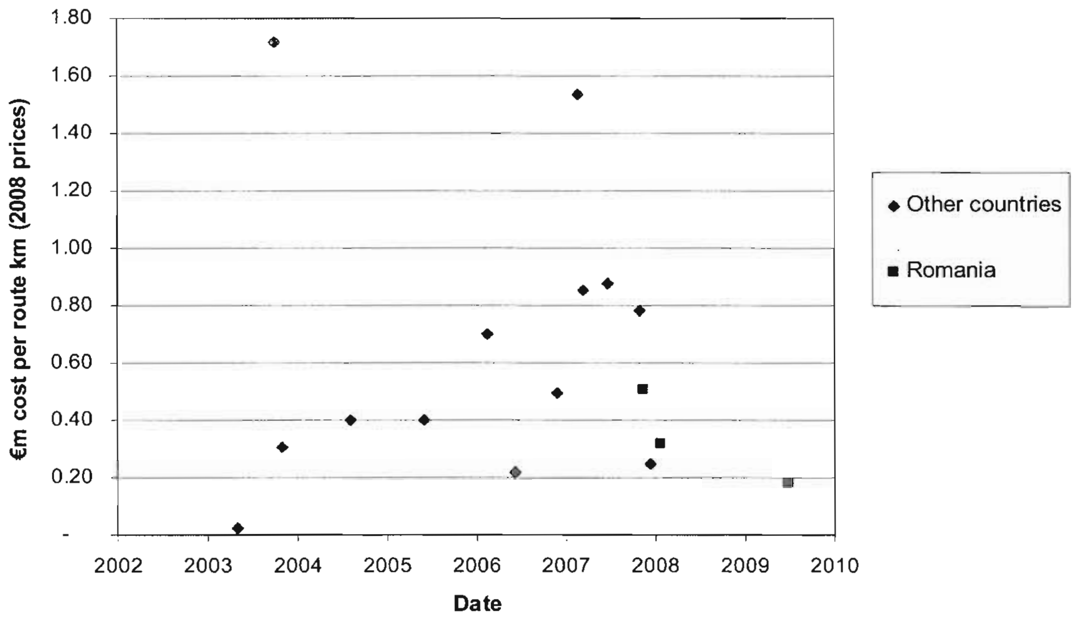


Compared with other countries, the unit costs for permanent way were in the mid to low range. There was some tendency for the unit costs in Romania to decrease in real terms over time.

3.2.2.5 Results: Signalling

Figure 3.10 shows the unit cost per route km for signalling in Romania compared with the other participating countries.

Figure 3.10: Cost per route km of signalling (mil EUR, 2008 prices)



This shows that the unit costs for Romanian signalling projects were in the mid to low range of those seen overall. Again there was a tendency for the unit costs to decrease over time in real terms.

3.2.2.6 Summary

The results from the cost benchmarking for the rail sector indicate that compared with the other countries taking part in the study, Romania has unit costs in the middle of the observed range for route upgrade, and unit costs in the low to middle end of the range for permanent way and signalling.

4 Review of Cost Estimating methodology

4.1 Terms of reference

We have re-ordered these sub tasks into a more logical sequence as follows:

Sub task 8.1: Review of *past performance* with regard to accuracy of estimation compared to contract prices and final outturn costs;

Sub task 8.2: Review and comment on *existing* cost estimating methodologies in the participating countries, particularly any prescribed industry standards;

Sub task 8.3: Review one sample estimate for a major project application to the EU per country and advise on its likely accuracy based on the results of the other sub-tasks

Sub task 8.4: Identify potential deficiencies in the methodology and propose improvements.

4.2 The accuracy of cost estimates: review of past performance

4.2.1 Road sector

In terms of past performance of cost estimation, whilst less than half of the projects in other countries exhibited a cost overrun between contract award and final outturn cost, in Romania it was almost two-thirds of projects. The Romanian projects studied showed some of the largest overruns in cost between contract award and completion.

Looking at the overall change in costs from appraisal to final outturn cost, projects in Romania were slightly more likely to overrun than those projects reviewed in the other countries studied.

Considering the results as a whole, it seems that for the projects reviewed in Romania cost estimates at appraisal are relatively accurate when compared to the cost at contract award, however the final outturn cost tends to increase from the cost at contract award stage resulting in most projects exhibiting cost overruns across the project cycle.

This suggests that there are likely to be issues with claims during the construction contract, which could be the result of selecting the lowest bidder.

4.2.2 Rail sector

Insufficient data was available for the rail sector to conduct an analysis of the accuracy of cost estimation.

4.3 Review of *existing* cost estimating methodologies

4.3.1 Introduction

During the early stages of a project many factors that influence project costs are not known, in addition there are also other process type factors that often drive project cost estimate increases, for instance:

- Inadequate cost estimating methodologies;
- Lack of allowance for inflation;
- Lack of sufficient contingency allowance
- Scope changes;
- Time delays between feasibility and the production of tender documents

Traditionally, estimating project construction cost has been based on a combination of listed items with quantities and unit rates. Using a system of measurable units, whether they are cubic metres of concrete, kilometres of highway pavement, or kilometres of railway tunnel, the total project cost is based on assigning a unit cost to each of the planned items involved in the final construction. This is conventionally called the 'base' project cost estimate. A contingency sum is usually added to the estimate to take account of any unknowns. Typically, the contingency value is a percentage of the total unit cost estimate or base cost. The contingency is often based solely on judgement or historical experience from similar projects. In our experience rarely, except on some very large projects, are the individual risks and opportunities quantified explicitly.

Essentially, the cost estimate is based on a defined or assumed set of quantities and a specification for the works. The greater the accuracy in the quantification and specification, the greater the accuracy of the estimate. However, it should be noted that a cost estimate is a forecast of cost. It relies upon judgment and the use of empirical data to assess the likely final cost of a project. It may include or exclude a risk allowance. Most importantly, an estimate is not a fixed figure and may be subject to continual review as project objectives, constraints or risks change.

This review was looking for evidence that a structured process was in place in Romania for estimating the capital cost budget for major infrastructure projects. More specifically:

- Are there standard national guidelines for producing cost estimates on road or rail infrastructure projects?
- At what project stages are cost estimates produced?
- Who was responsible for producing the cost estimates at each of the project stages?
- What type of cost estimating methodology was employed at each of the project stages?
- What source of cost data was used to provide the estimates at each of the project stages?
- Were cost estimates developed incrementally, that is at each of the project stages?
- Were contingencies considered at each of the project stages?
  - How were contingencies included on the project?
  - What percentage is included for contingencies?
- Were the cost estimates independently verified at each project stage?

4.3.2 Cost estimating approach in Romania - road sector

4.3.2.1 Agency procedures

We were informed that there is a serious lack of any cost estimating expertise in Romanian government departments currently, most cost estimates are produced by external consultants usually engineering design firms, often these are international firms. These companies are also usually responsible for any subsequent surveying and measurement.

Furthermore, the widespread adoption of FIDIC contract forms in Romania has created a potential problem for the Beneficiaries. Currently there isn't sufficient expertise in-house at RNCMNR to deal with contract management issues. This inevitably leads to delays in processing payment, claims, etc which ultimately can lead to cost increases.

4.3.2.2 Stages estimates prepared

No evidence provided.

4.3.2.3 Current approach used

No evidence provided.

4.3.2.4 Availability of cost data

No evidence provided.

4.3.2.5 Approach to contingency/risk

For ISPA contracts, contingencies are generally included on road infrastructure projects in Romania as a separate allowance of 5%. Some time ago PHARE contracts used a 10%

contingency. Since early 2008 a Romanian law introduced an increased contingency of 10% which will be used in future contracts. We believe that any contingency allowance should vary with contract size and duration to cover eventualities that may arise during all stages of the project cycle.

4.3.2.6 Method of verification

No evidence provided.

4.3.3 Cost estimating approach in Romania - rail sector

4.3.3.1 Agency procedures

Cost estimates made at all project stages are prepared by external consultants usually design engineers. There are no standard national guidelines for cost estimating on rail infrastructure projects in Romania.

Respondents highlighted significant problems with cost estimation procedures in the Romanian rail infrastructure sector, particularly for early stage estimates which they suggested lacked sufficient detail. We were informed that there is a serious lack of any cost estimating expertise in Romanian government departments currently.

4.3.3.2 Stages estimates prepared

No evidence provided.

4.3.3.3 Current approach used

The current approach is, by and large, based on past experience i.e. what happened on previous projects. We were informed that CFR were keen to have a more formalised procedure for developing cost estimates, our respondents suggested that this should come from the EU in the first instance and subsequently be adopted by the Romanian government.

Generally, on rail infrastructure projects in Romania the final outturn price is not usually the price agreed at procurement stage. There are often cost increases during the construction phase, mainly claims for scope changes. As a result the Managing Authorities apply pressure to the railway administrations project managers to try and minimise the number of change orders.

The current procedure for approving change orders was regarded as particularly difficult with the result that processing/approving them can take up to 5/6 months. The respondents suggested that this process results in delay and ultimately increased cost during the construction phase.

We note that claims have been an issue on some past projects funded by the EU in Romania, the 28 day clause in the FIDIC Conditions of Contract for the notification of a claim may have the result of leading to a culture of excessive claims on rail infrastructure projects.

There are also issues regarding blockages in the funding process, in particular with projects that are co-financed (i.e. EIB/EC/EBRD) where each organisation may have conflicting arrangements for billing. This can lead to delays in payment, claims and increased costs. One single point of responsibility (i.e. overall financing) may make the system simpler for Beneficiaries.

Generally on rail infrastructure projects in Romania most cost increases occur after the procurement of a contractor, usually these relate to delays in the project.

Furthermore, at award stage the lowest bidder is usually selected, indeed this it was suggested is a requirement of some funding organisations. This approach can lead to problems in terms of claims during the construction phase and ultimately to increased costs over the project lifecycle.

In addition, land acquisition can be problematic in both the rail and road sectors, appropriating land in Romania can hold up projects and lead to cost increases. However, we were informed that the law is about to be changed in respect of road infrastructure but not for rail projects.

4.3.3.4 Availability of cost data

External consultants are responsible for producing cost estimates and use their own proprietary cost databases.

4.3.3.5 Approach to contingency/risk

Contingencies are included on rail infrastructure projects in Romania usually as a separate allowance of just 5%. We believe that any contingency allowance should vary with contract size and duration to cover eventualities that may arise during the period.

4.3.3.6 Method of verification

All cost estimates produced are assessed by the Ministry of Transport, usually including an assessment of any unit rates (i.e. km/€), based on experience of similar projects. No formal verification is carried out..

4.4 Review of a major project application cost estimate

4.4.1 Road sector

Project: Cernavoda – Constanta Motorway

Date of preliminary estimate: September 2005

From this sample estimate that we reviewed (and other similar projects), it appears that one of the reasons for cost overruns is likely to be the inclusion of inadequate contingency allowances in cost estimates prepared by RNCMNR. The contingency allowance in the cost estimate for this project was only 5%

In our opinion and based on the evidence of our review of the cost estimation methodologies in the Romania Roads Administration, we believe that any future major project application to the EU is likely to be an under-estimate of costs over the project lifecycle. We believe that further consideration should be given to the provision of adequate contingency allowances in cost estimates prepared by RNCMNR more generally.

4.4.2 Rail sector

No specific evidence provided.

4.5 Potential deficiencies and proposed improvements

4.5.1 Conclusions

Cost estimates are central to establishing the basis for key project decisions, for establishing the metrics against which project success will be measured and for communicating the status of a project at any given point in time. However, cost estimating on infrastructure projects is inherently difficult given the high degree of uncertainty on schemes that can run for a number of years. Our review has highlighted evidence of cost increases/decreases on some of the projects considered in Romania, which is likely to be the result of a number of factors, including:

- Inadequate contingency allowance
- Inadequate number of stage estimates
- Lack of allowance for inflation

Following a review of the cost estimates made at various stages of the projects lifecycle it is our view that those made at the earliest stages i.e. the initial estimates were not sufficiently detailed. Broadly speaking they followed a relatively high-level project appraisal approach and seemed to be short of detail. Furthermore, cost estimates appear to be made at relatively few project stages. Ideally, cost estimates should be made at the following 11 project stages:

1. feasibility study
2. funding agency appraisal report
3. decision-to-proceed/commitment from funding agency
4. outline design
5. detailed design/issue of tender documents
6. receipt of bids
7. receipt of all critical permits and approvals
8. signing of contract with winning contractor
9. during construction
10. at the time of project opening for traffic
11. handover of completed works/final account settlement with contractor (return of Performance Security)

4.5.2 Recommendations for Romania

As a minimum we recommend that detailed cost estimates are produced at the following three project stages:

1. feasibility study
4. outline design
5. detailed design (detailed cost estimate based on BoQ)

with a subsequent calculation of the values of:

6. receipt of bids (tender value = contract price)
9. construction (contract price plus claims)
11. handover (contract price plus claims plus penalties/rewards)

In addition, it seems that the early stage cost estimates are often developed before there is sufficient design information for the estimates to be reliable. Where possible, early stage cost estimates should be based on more advance preliminary design information. We recommend that budgets are developed incrementally, stage by stage, until cost estimates are reasonably robust at project procurement stage.

The following recommendations should be adopted in Romania as soon as is practicable to improve the current cost estimating procedures.

- For early stage estimates we believe that it may be beneficial to provide cost estimates represented as a range between a realistic minimum and maximum rather than as a single point estimate. This approach could also be usefully applied to the time period over which the project lifecycle will take place or, at a minimum, the first of the three stages above.
- Systematically define the level of detail required for cost estimates at each (of the first three) stage of the project lifecycle listed above. The level of detail required at each stage would be:
  - Feasibility – unit rates for major construction items derived from past experience of similar projects plus allowance for inflation and contingency

  - Outline design – estimate based on the conceptual design of the project when the basic technologies for the design are known plus allowance for inflation and contingency
  - Detailed design – detailed cost estimate based on individual item rates derived from plans/specification (BoQ) plus allowance for inflation and contingency

- Ensure that appropriate expert input is applied to each cost estimate.
- Agree with Funding agencies and adopt realistic forecasts of future cost inflation, based on an index designed specifically to reflect trends in infrastructure construction if available or alternatively one of the wider economic measures of inflation. This is linked to the need for systematic definition as in many cases Consultants do allow for inflation in the unit cost estimate but do not make it visible and transparent. Therefore a systematic cost definition frame which included for example inflation and contingency (with a distinction between price and physical contingency) would help.
- Establish a unit cost database from all projects, to be maintained and updated permanently by the agencies and provided to Consultants for feasibility studies. This would contribute to the robustness/reliability of future cost estimates.

Recommendations regarding contingency allowances are provided in Appendix B, Section B4.5 (Quantitative Risk Assessment Guidance).

5 Formulating a standard Price Adjustment Clause and review of Bill of Quantity

5.1 Terms of reference

5.1.1 Introduction

The price variation of construction materials and supplies such as asphalt, fuel, cement and steel can result in significant problems for contractors in preparing bids on long term projects. In some cases, prospective bidders cannot obtain firm price quotations from material suppliers for the duration of the project. This leads to price speculation and inflated bid prices to protect against possible price increases.

However, if price adjustment provisions are used in the contract to respond to any price variation, a portion of the risk is transferred to the contracting agency, which can be expected to result in lower bids. Although it should be remembered that, since the contracting agency may have to increase the prices paid to the contractor, a reserve amount (in the form of a contingency allowance) must be set aside and included in the overall budget allocation for the project.

5.2 Review the current standard contract used in the participating countries and formulate standard Price Adjustment Clauses

5.2.1 Practical guide to contract procedures

The latest "Practical guide to contract procedures for EC external actions" (PRAG)[5] was published in 2008 by the EuropeAid Co-operation Office. PRAG describes the rules to be followed and explains the contracting procedures applying for all EC external aid contracts financed from the European Communities' General Budget (the Budget) and the European Development Fund (EDF). The guide only applies to the contracting part of the implementation of a project: the rules applied from 1 January 2009 to all procedures started following calls for proposals and calls for tenders published after this date. Since it incorporates the relevant legal texts for contracts that are let under the Budget and the EDF, the purpose of this practical instrument is to provide users with all the information necessary for procurement or making grants.

5.2.1.1 Use of FIDIC contracts in European programmes

PRAG is for programmes managed by the EuropeAid Co-Operation Office or for those for which the Office defines the rules, in co-operation with other EC services. It is applicable provided that "the regulations and other specific instruments adopted for the various co-operation programmes do not foresee other provisions".

Hence if a specified programme foresees other provisions, for instance the use of Conditions of Contract other than the Guide's EU Conditions of Contract, this is allowed, provided the contract is implemented under EC regulations as specified in the guide.

The result is that, for many EU programmes, a contracting authority can often use, or request permission to use, FIDIC Conditions of Contract together with EU Special Conditions. Indeed, many national contracting authorities are continuing to specify the use of FIDIC Conditions of Contract since they and their contracting parties have extensive experience in using the FIDIC conditions which have been adopted in a modified form by the Multilateral Development Banks and are in widespread use around the world.

The implementation of an EU programme will thus typically specify in a memorandum of understanding the preparation of FIDIC contact documents and tender documents in accordance with national standards and PRAG procurement rules.

[5] EuropeAid Co-operation Office (2008) Practical Guide to Contract Procedures for EC External Actions

5.2.2 Forms of contract used in Romania

5.2.2.1 Road sector

Until recently, FIDIC Red and Yellow Book Conditions of Contract were widely used on road infrastructure projects in Romania. In fact, in 2007 both FIDIC forms were translated and written into Romanian law as being mandatory. However, the law was repealed in 2009 and Beneficiaries are now free to use these or other forms of contract.

In practice, FIDIC Red and Yellow Book Conditions of Contract are still routinely used on road infrastructure projects particularly if they are funded through International Financial Institutions (IFIs). In addition, a local form of contract loosely based on FIDIC Orange Book Conditions of Contract has also been used on road infrastructure projects, although it is not as comprehensive as the FIDIC form.

However, when used the FIDIC forms are routinely modified to restrict the authority of the Engineer to determine extensions of time, claims and variations. This can cause problems as the Romanian Roads Administration (RNCMNR) are often reluctant (or incapable) of making decisions involving additional payment. This may result in project delays, work suspensions, claims and conflict.

Furthermore, the RNCMNR often see the contractors as being at fault and routinely build into the contracts onerous penalties (in addition to liquidated damages), which we believe may lead to higher bid prices.

Until recently, tender and contract documents were published in English, however Romanian is now widely used. We believe that this practice is likely to deter foreign firms from the market and lead to decreased levels of competition, and the potential for increased bid prices.

5.2.2.2 Rail sector

Until recently, FIDIC Red and Yellow Book Conditions of Contract were widely used on rail infrastructure projects in Romania. In fact, in 2007 both FIDIC forms were translated and written into Romanian law as being mandatory. However, the law was repelled in 2009 and Beneficiaries are now free to use these or other forms of contract.

In practice, FIDIC Red and Yellow Book Conditions of Contract are still routinely used on rail infrastructure projects particularly if they are funded through International Financial Institutions (IFIs).

We were informed that the widespread adoption of FIDIC contract forms in the recent past had created a problem for the Beneficiaries. More specifically, there wasn't sufficient FIDIC expertise in-house to deal with contract management issues. This inevitably led to delays in decision making which ultimately, we believe, may have been a contributory factor in any cost increases post contract award.

5.2.3 Review of standard forms of contract used

According to the EIB's Guide to Procurement (2004)[6] "Promoters may use the conditions of contracts originating from their country's legislation, but they are encouraged to use internationally-recognised standard procurement documentation such as the Master Procurement Documents and User's Guides prepared through the joint efforts of the Multilateral Development Banks and International Financial Institutions and available on the World Bank's website and the FIDIC website, provided that these are compatible with the provisions of this Guide".

In Romania the use of FIDIC Conditions of Contract for infrastructure projects was widespread (until the recent past) and in the absence of any alternative below we summarise the main differences between the FIDIC forms.

[6] European Investment Bank (2004) Guide to Procurement, JASPERS

The FIDIC suite of contracts are founded in English law, with the Red Book 1st edition (1957) being based on 'ICE 4' (Institution of Civil Engineers, 1954). They are recommended for use where tenders are invited on an international basis and predominantly used on civil engineering projects.

FIDIC Red Book

The Red Book is the traditional form for civil engineering construction in which the Contractor constructs to the employer's design. The defining characteristics of the contract are the concepts of contract price and measurement but with provision for re-measurement. The role of the Engineer is pivotal, given their responsibility for measuring the works, albeit that the measurement is carried out in accordance with the measurement and evaluation contract schedules (Clause 12).

FIDIC Yellow Book

The Yellow Book is the conditions of contract for plant and design/build projects and covers "Electrical and mechanical plant, and for building and engineering works designed by the contractor". The majority of the clauses contained in the Yellow Book are the same as those in the Red Book, the main differences derive from the Contractor being responsible for the detailed design in accordance with the Employer's Requirements. The Engineer administers the contract and payment is based on time periods or instalments of the Lump Sum (the Contract Price).

FIDIC Pink Book

The Pink Book is the Multilateral Development Banks (MDB) harmonised edition of the FIDIC Red Book. The Pink Book is the form of contract adopted by MDBs for construction projects designed by the Employer, for which MDBs are providing finance.

The Pink Book was first introduced in 2005 (revised in 2006). Prior to this, MDBs commonly requested the Red Book as part of the standard bidding documents that they required their borrowers or aid beneficiaries to follow. However, the beneficiaries often heavily amended the General Conditions of Contract by introducing additional or modified clauses. These additional clauses were not standard and were often repeated with local variations when bidding documents were prepared, which led to inefficiencies during the procurement stage and caused uncertainties amongst users of the documents.

The Pink Book is a harmonised version of the Red Book including the most common changes previously introduced by beneficiaries and now standardised by the MDBs. The Pink Book is suitable for any projects where the Red Book would have been applicable.

FIDIC Orange Book

The Orange Book is the conditions of contract for design/build and turnkey projects. As with the Yellow Book the design is the responsibility of the Contractor. The main difference is that Turnkey contracts include most or all of the fixtures, fittings and equipment required for the provision of a fully-equipped-facility, ready for operation (at the turn of the "key").

The majority of the clauses contained in the Orange Book are the same as those in the Red Book, the main differences derive from the Contractor being responsible for the detailed design in accordance with the Employer's Requirements. The Engineer administers the contract and payment is based on time periods or instalments of the Lump Sum (the Contract Price).

5.3 Review the standard of bill of quantities used and formulate possible adjustment/modifications to facilitate easy implementation of the price adjustment clause

5.3.1 Introduction

The price adjustment clause (PAC) method of adjusting contract cost is based on cost adjustment formula containing resource coefficients, representing the costs of labour, equipment and material resources as percentages of the total cost, combined with cost indices for each of those resources. The resource coefficients are set by the tenderer when completing the appropriate Appendix to Tender. It is also usual practice for the tenderer to define the source of the indices (normally linked to the currency of payment).

We believe that there is no direct link between a Bill of Quantities and a PAC as implied by the Terms of Reference for this study. A BoQ to be priced by bidders is an integral component of a contract using the FIDIC Red or Pink Book but a PAC can be included or not at the choice of the Employer (similarly with a FIDIC Yellow Book contract). In defining the resource coefficients, the tenderer does not draw directly on the data that they provide in pricing the BoQ (the tendered rates) but takes a contract-wide view of the relative costs of their primary inputs.

5.3.2 Treatment of inflation in the road sector

RNCMNR include allowance for price adjustment on road infrastructure projects in Romania that run over two years. The standard clause (13.8) in FIDIC Red and Yellow Book Conditions of Contract is commonly used for price adjustment. Generally, an indices based adjustment formula is used on projects financed by IFIs and the State. The, indices (usually a basket of 6/7 items) are produced by the Romanian National Statistical Office (NSO). However, projects financed by ISPA and Phare grants/loans don't usually include price adjustment mechanisms due to their fixed price contract.

5.3.3 Treatment of inflation in the rail sector

The Romanian Railways (CFR) believes that an equitable sharing of risk is appropriate in construction contracts that run for a number of years. Therefore, allowance is made for price adjustment on rail infrastructure projects in Romania that run over two years. The standard clause (13.8) in FIDIC Red and Yellow Book Conditions of Contract is commonly used for price adjustment.

5.4 Detailed instructions on the use of price adjustment and implementation thereof

5.4.1.1 Introduction

There is a fundamental difference between calculating price adjustment (up or down) on a range of actual costs and calculating price adjustment by formula methods. With actual costs, price adjustment is a net amount calculated from wages sheets, invoices and the like in accordance with the provisions of the contract. Price adjustment is applied only to those materials on an agreed basic list, and there is usually no specific provision for the adjustment of overhead and profit.

However, formula price adjustment is calculated from the movement in index values irrespective of actual costs (or savings) incurred by the contractor. Individual rates included in the build-up of a tender are not used in the price adjustment calculation. There is a need, therefore, to specify the classes of materials subject to adjustment but no need to submit a list of the prices of all materials. There is no need to take account of or document future changes in wages and salaries because these fluctuations are accommodated by the application of an index covering labour costs.

It is important that users of formula methods of calculating price adjustment should appreciate that it does not purport to reflect with accuracy every minor change in construction costs or resource prices. It is a method designed to reasonably compensate the contractor for increases and reduce the delays and labour associated with traditional methods of payment.

A Price Adjustment Clause in the conditions of contract would provide a method of sharing the risk of construction cost increases and thereby promote improved competition for infrastructure projects in the firm expectation of lower bid prices. The following section highlights the current international practice for price adjustment and sets out a detailed plan for the incorporation of price adjustment provisions in international and local contract forms used in infrastructure tender documents in Romania.

FIDIC adopted the use of the method of price adjustment by a simple formula in their 1999 Revised Conditions of Contract and this is now widely accepted in the international construction community as being the preferred method of price adjustment.

When formula price adjustment is used, appropriate clauses **must** be included in the Conditions of Contract. Standard forms of contract conditions to implement the price adjustment formula are available from a number of organisations. In this instance those included in the FIDIC forms are perhaps the most appropriate given the widespread use of FIDIC-based contracts in the past on internationally-financed infrastructure projects in Romania.

5.4.1.2 Use of PAC within FIDIC Red, Pink and Yellow Book Contracts

The following describes the use of the price adjustment clause within these FIDIC contract forms.

Price adjustment is applied to valuations as stated in the individual conditions of contract, normally at monthly intervals.

Definitions

Base month

The calendar month defined in the tender documents, the index numbers of which equate to the price levels represented by the rates and prices contained in the tender.

The base month is usually the calendar month prior to that in which the tender is due to be returned.

Value of work executed

The gross value (before deducting retention) of work properly executed in the valuation period, including variations, which is subject to price adjustment.

Valuation period

The period in which the work being valued was executed.

Exclusions from adjustment

Price adjustment is applied as stated in the specific conditions of contract. Usually the following items are not subject to adjustment:

- Any part of the contract sum designated by the Employer as not being subject to price adjustment, in particular the "non adjustable element" (see following sub-heading)
- Unfixed materials on site (except where specifically subject to price adjustment as part of the formula)
- Any credit allowed for old materials arising from the works

Non-adjustable element

The method provides for a non-adjustable element which is any part of the contract sum designated by the employer as not being subject to price adjustment. The figure of 10% is often used in the case of externally-funded projects. However, users' circumstances may require a different value or exclude the non-adjustable element altogether.

FIDIC Clause 13.8 - Adjustments for Changes in Cost

Both the FIDIC Red and Yellow Conditions of Contract Clause 13.8 (Adjustment for Changes in Cost) state that:

"In this sub-clause, 'table of adjustment data' means the completed table of adjustment data included in the Appendix to Tender. If there is no such table of adjustment data, this sub-clause shall not apply.

If this sub-clause applies, the amounts payable to the contractor shall be adjusted for rises or falls in the cost of labour, goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formula prescribed in the sub-clause. To the extent that full compensation for any rise or fall in costs is not covered by the provisions of this or other Clauses, the accepted contract amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formula for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formula shall be of the following type:

Pn = a + b(Ln/Lo) + c(En/Eo) + d(Mn/Mo) + ...

Where:

Pn is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period "n", this period being a month unless otherwise stated in the Appendix to Tender.

a is the fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments.

b; c; d;.....coefficients representing the estimated portion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

Ln; En; Mn; ...are the current cost indices (labour, equipment and material resources) or reference prices for period "n" expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

Lo; Eo; Mo;... are the base cost indices (labour, equipment and material resources) or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulate cost element of the base data.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates (quoted in the fourth and fifth columns respectively of the table) for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the "currency of index" (stated in the table) is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the Central Bank of the country, of this relevant currency on the above date for which the index is required to be applicable.

Until such time as a relevant current cost index is available, the Engineer shall determine a provisional index for the issue of the Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either: (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price: whichever is the more favourable to the employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations" (FIDIC 2007, Conditions of Contract for Construction).

Worked example of cost adjustment

Tables 1 and 2 provide a worked example of the calculation of price adjustment using the formula method described in FIDIC Clause 13.8:

$Pn = a + b(Ln/Lo) + c(En/Eo) + d(Mn/Mo) + \ldots\ldots\ldots\ldots$

More specifically, Table 1 provides an example of the estimation of adjustment multipliers, while Table 2 provides an example of cost adjustment in a payment certificate.

Table 1: Estimation of adjustment multiplier

Resource	Code	Coefficient	Base Index	Current Index	Adjustment multiplier
Non adjustable portion	NA	0.10	NA	NA	0.100
Professional staff and labour	L	0.15	183.2	192.4	0.158
Construction equipment	E	0.20	153.5	158.1	0.206
Fabricated structural steel	M1	0.15	231.5	240.8	0.156
Steel reinforcement	M2	0.10	229.7	238.9	0.104
Brick and clay products	M3	0.02	123.3	127.0	0.021
Cement and concrete products	M4	0.01	165.4	170.4	0.010
Bitumen and bituminous products	M5	0.25	223.6	232.5	0.259
Timber products	M6	0.02	132.8	136.8	0.021
Total		**1.00**			1.035

It is important to note that the unadjusted value in Table 2 includes the value of work measured, Dayworks and Variations all at BoQ tendered rates.

Table 2: Price adjustment calculation

Cost adjustment for period n	Value
Measured work items at BoQ rates	35,156,121.05
Dayworks valued at BoQ rates	1,564,784.00
Variations valued at BoQ rates	3,589,145.00
Unadjusted value	40,310,050.05
Adjusted value (1.035 x unadjusted value)	41,720,901.80
Cost adjustment for period n	1,410,851.75

We recommend that all contracts procured using FIDIC Conditions of Contract adopt Clause 13.8 for price adjustment where the contract period is more than 12 months.

5.4.1.3 Use of PAC within local contracts

Furthermore, we recommend that where local forms of contract are used (with a duration in excess of 12 months) that do not already contain recognised provisions for price adjustment, the FIDIC methods are adopted. However, where this is not feasible because the applicable indices and the resource coefficients have not been defined within the contract, we outline in Appendix A a simplified price adjustment clause for use within ongoing and future local contract forms in Romania.

5.4.1.4 Publication of indices

General construction indices are produced by the National Statistical Office (NSO) on a quarterly basis. Romania has been subject to some very high increases in the costs of construction materials and labour over the last few years.

Both CFR and RNCMNR use the quarterly general construction cost series to monitor inflation trends in construction more generally, as the current infrastructure indices are not regarded as being robust/reliable enough to be used for the treatment of inflation.

However, price adjustment calculations are usually based on monthly index series. Currently, only quarterly indices are available in Romania and it would be beneficial for cost indices to be published on a monthly basis to match monthly contract valuations. We appreciate that this will involve additional work for the NSO but believe that the advantages of not having to make use of provisional indices would be beneficial.

In the interim FIDIC gives the Engineer discretion to set indices when none are available. Therefore, we suggest that if quarterly indices are to be used for adjustment for month 1 and month 2, an index could be increased by the same percentage as in the third month of the preceding quarter, with a final correction in month 3 of the current quarter. As necessary, this approach could also be adopted on local contracts.

5.4.1.5 Conclusions

In Romania, until the recent past, the use of FIDIC contract forms for internationally-financed road and rail infrastructure projects was mandatory. And although the law was repealed in 2009 and Beneficiaries are now free to use these or other forms of contract, in practice, FIDIC Red and Yellow Book Conditions of Contract are still routinely used on infrastructure projects particularly if they are funded through International Financial Institutions.

We believe, therefore, that the adoption of the PAC mechanisms within the FIDIC forms should be encouraged on contracts over 12 months in duration. Furthermore, we suggest that where local forms of contract are used, on projects over 12 months in duration, these should be reviewed with a view to the inclusion of price adjustment clauses based on the FIDIC methodology (outlined above in Section 5.4.1.2). However, where this is not practicable, we outline in Appendix A a simpler approach for the adoption of a price adjustment clause for use within local contract forms in Romania.

6 Risk Management

6.1 Introduction

This chapter relates to Task 10 of the commission namely, to *Develop Guidance on Risk Management during the Project's Lifecycle.*

The primary purpose of Task 10 is to understand how the management of risk currently informs the project cost estimate at appraisal and thereafter contributes to the cost outturn. The review compares how risks are currently managed with what the reviewers consider to be best practice. The latter comprises an amalgam of proven risk management practices worldwide, which can sensibly be tailored and applied in Romania on its transport investment projects.

6.2 Scope

Risk management practice, at all project lifecycle phases, has been reviewed. Data have been collected from both the rail (CFR) and road (NCMNR) beneficiaries, as well as the Ministry of Transport (MT). The review has concentrated on the four key risk management elements, namely:

1. Risk identification;
2. Risk assessment (including risk analysis);
3. Risk response planning;
4. Risk monitoring.

6.3 Methodology

6.3.1 Data Collection

Data were collected via separate meetings with representatives from the two beneficiaries. Both meetings were also attended by MT. The EIB was represented at the NCMNR meeting. Raw data from these interviews are appended to this report. A questionnaire was forwarded in advance of the scheduled interviews.

6.3.2 Classification Scheme for recommendations

Commentaries and recommendations are provided for each risk management element (e.g. planning, identification, assessment etc.). Recommendations are categorised to give an indication of their importance, as follows:

Category 1:	Significant: needs to be addressed if cost risk management is to be effective and reliable;
Category 2:	Moderate: its implementation will most likely facilitate the risk management process;
Category 3:	Minor: to provide clarification.

6.4 Results

6.4.1 Risk Management Guidance

Other than the EC's *Guide to Cost-Benefit Analysis of Investment Projects*, there is no explicit risk management guidance. Applications for funding are governed by the prevailing regulatory environment (incl. civils proceedings codes, environmental law, building codes). Design consultancies, employed by the beneficiaries, use their own methods of risk assessment. Notwithstanding, NCMNR's new specialist risk unit *Management of Irregularities, Risk and Audit* have recently drafted risk management guidelines [*Ref.1: Attachment 4, Risk Management Guidebook – Clarification Note & Procedural Clarifications*) for application by end 2009. This Guidebook contains guidance on the key elements within the management system's approach to risk.

6.4.2 Actual Risk Management Practice

6.4.2.1 Overview

Design consultants are commissioned to undertake feasibility studies. They follow their own procedures, but ensure risk analyses at feasibility stage follows the EC's CBA guidelines. These are checked in-house by NCMNR/CFR, reviewed by MT's *Committee of Evaluation* and subsequently forwarded to Jaspers. No evidence was sought as to the level of checking provided by the beneficiaries.

6.4.2.2 Risk Identification

The identification of project risks is the responsibility of the design consultant. Risk perception by the beneficiaries, especially CFR, is based primarily on experience of comparable historical projects. This can provide a reliable means of risk identification. However, historical data on costs at outturn relative to appraisal would suggest that its identification method is not effective. One possible cause is that risk registers are not required to be drafted or maintained. If done properly, project-specific risk registers can afford the following benefits:

- Assurance that a comprehensive list of risks has been identified and so provide for reliable assessments of cost risk exposure;
- Tailored assessments to suit each individual project;
- Cost-effective evaluation of risk response plans;
- Reliable indication of risk reduction performance of risk response plans;
- Reliable risk-related information for future projects.

Recommendation 1.01: *Mandate the drafting and maintenance of a risk register for all projects seeking EC funding*

It would be worth considering employing more systematic methods of risk identification for any significantly different projects. There are several reliable techniques that could be used to supplement risk-related information from historical projects. Indeed, NCMNR's *Risk Management Guidebook* includes a comprehensive list risk identification guidewords in *Attachment 5: Risk Index* to prompt the systematic identification of project-specific risks.

Recommendation 2.01*: Consider employing complementary methods of risk identification, including NCMNR's Risk Index and developing a database of project risks to inform risk exposure on future, comparable projects and the effectiveness of risk response measures.*

6.4.2.3 Cost Risk Quantification

No quantitative risk analysis (QRA) is run in order to estimate a contingency reserve and hence inform the project budget. Cost contingencies are estimated using a percentage uplift to spot estimates; the uplifts being used to account for two sources of error, namely chance events and estimating uncertainty. The NCMNR uses a maximum 10 percent uplift at each stage. CFR use maximum uplifts of 10 percent and 20 percent for new and rehabilitation works respectively. The latter are used to publicise maximum permissible prices in project tender documentation.

These uplifts may well be informed by a beneficiary's perception of a project's risks. But they do not appear to be based on comprehensive risk assessments, which can be scrutinised or audited. There are two potential adverse consequences: the first is that a percentage uplift is applied unnecessarily, thereby making the project prohibitively expensive; the second is that the outturn cost is underestimated and the beneficiary/Treasury has to fund the shortfall once EC grant funds are exhausted.

As has been mentioned above, the project costs at outturn nearly always exceed the estimate at appraisal and contract award. Underestimating the contingent reserve is only one possible cause; the others including cost estimating and contract management. It is understood that contractual clauses are amended to account for historical project performance, although no evidence was provided. Again, an historical risk database would allow risk causation and control to be tracked and so provide evidence of the effectiveness of existing and the need for additional risk response measures (see *Recommendation 2.01*).

Historical costs and prices should inform appraisal cost estimates and tendered prices for comparable projects. In other words, cost estimates and prices should be market-tested and reflective of prevailing market conditions. Yet, it is not clear whether such data are recorded. If the methods of cost estimating are not to change, then consideration should be given to relaxing the contingency reserve limits or to further contractual risk transfer; the latter potentially reducing market interest and hence inflating tender prices. It is understood that NCMNR's guidance is to be extended in 2010 to include guidelines on QRA. This should provide for more reliable estimates of necessary contingent reserves. The beneficiaries can then select a confidence value from the cost risk distribution, mindful of the market context and the likely effect on marketplace competition.

***Recommendation 1.02**: Consider developing database(s) to record historical tendered prices and causes/amount of escalation post contract award. Improved cost estimation procedures are needed in their own right but also form an integral part of risk management.*

***Recommendation 2.02**: Extend NCMNR Risk Management Guidebook to include guidance on cost QRA*

6.4.2.4 Risk Response Planning

Alternative procurement structures (esp. design and build, design-bid-build) are used to optimise risk transfer. Common risks (e.g. inflation and exchange rate fluctuations, contractor default) are allocated under terms and conditions of contract. Indeed, as mentioned above, contractual clauses are adjusted to account for experience of comparable historical projects (e.g. CFR's limiting the proportion of works that can be subcontracted by the successful bidder, and CFR's introduction of staged/milestone payments & associated penalties for late delivery). The allocation of contingent reserves, as a risk acceptance strategy, is discussed in Section 6.4.2.3.

But, as with other risk management elements, there is little evidence that risk response planning is systematic. The project risk register needs to include detailed risk response planning information at all project lifecycle phases. By so doing, it demonstrates that the beneficiary understands what the key risks are and has planned to ensure its related exposure is kept within tolerable limits.

***Recommendation 2.03:** Ensure project risk registers have columns/fields for populating and managing risk response plans*

6.4.2.5 Risk Monitoring

Insufficient evidence.

6.5 Conclusions

It would appear that risk management is being applied, but the process is not especially structured and there are certain risk management elements that are missing. Risk management is therefore unlikely to provide reliable contributions neither to the economic/financial models nor to estimating cost budgets, as is evidenced by the tendency of projects to overspend. NCMNR's *Risk Management Guidebook*, suggests a more systematic approach to risk management is soon to be adopted, at least within roads agency. The recommendations that have been advanced are considered to represent additional, practical improvements that can be made without making the risk management process overly burdensome.

6.6 Recommendations

6.6.1 Category 1

Recommendation 1.01: *Mandate the drafting and maintenance of a risk register for all projects seeking EC funding*

Recommendation 1.02*: Consider developing database(s) to record historical tendered prices and causes/amount of escalation post contract award. Improved cost estimation procedures are needed in their own right but do form an integral part of risk management.*

6.6.2 Category 2

Recommendation 2.01*: Consider employing complementary methods of risk identification, including NCMNR's Risk Index and developing a database of project risks to inform risk exposure on future, comparable projects and the effectiveness of risk response measures*

Recommendation 2.02*: Extend NCMNR Risk Management Guidebook to include guidance on cost QRA*

Recommendation 2.03: *Ensure project risk registers have columns/fields for populating and managing risk response plans*

6.6.3 Category 3

None

7 Conclusions and Recommendations

7.1 Conclusions

7.1.1 Market Context

A complex web of supply and demand-side issues (set out in chapter 2, with some project level evidence in chapter 3) has affected the development of road and rail construction costs since 2001. Prominent amongst these has been the construction boom over the period 2004-2008, and weak public sector capacity affecting the management of design, contract award, supervision of works and construction. Combined with complex procurement and legal frameworks few foreign contractors have been encouraged to invest and stay in the Romanian road and rail infrastructure markets. The upshot of these circumstances has been that the implementation of many projects has been delayed and construction costs have increased significantly faster than consumer prices in general.

Whilst these remarks apply to the road and rail markets in general, the volume of road work is sufficient and generally sufficiently standardised that a mature market process should by now have evolved. Aspects of the rail works are more complex so that, in some cases, the very nature of the works can limit competition for contracts.

7.1.2 Cost estimation and use of Price adjustment Clause (PAC)

The cost estimation process appears to be relatively accurate compared to other countries. However, the final outturn cost tends to increase from the cost at contract award, suggesting that there are likely to be issues with claims during the construction contract, which could be the result of selecting the lowest bidder and inadequate contingency allowances. Price Adjustment Clauses (PACs) are used in both the road sector and the rail sector on some projects that run for over two years. Whilst the benefits of greater use of PACs are debateable, our preference is that they should be adopted on all contracts of over 12 months' duration to enable more effective management of the construction sector and greater predictability of bid prices.

7.1.3 Risk Management

Whilst risk management is being applied, the process is not well structured and certain elements appear to be missing. However, the NCMNR's recently published Risk Management Guidebook suggests the potential for a more systematic approach in the roads sector.

7.2 Recommendations to reduce construction cost inflation

7.2.1 Costing methodology and use of Price Adjustment Clause

We recommend the following actions to address this situation:

1) The adoption of price adjustment mechanisms to respond to any price variation during construction for contract periods longer than 12 months. This will require some additional resource to be committed by the beneficiary agencies but will ensure that contractors do not price for PAC covered risks ;

2) Further detail should be provided in early stage cost estimates (specifically feasibility stage) – including costs represented as a range (between a realistic minimum and maximum) rather than a single point estimate;

3) Cost estimates should be produced at three project stages as a minimum;

4) The inclusion of contingencies (both physical and price) in cost estimates produced at all stages of the project life-cycle.

5) A unit cost database from all projects should be established, to be maintained and updated permanently by the agencies and provided to Consultants for feasibility studies. This would contribute to the robustness/reliability of future cost estimates.

7.2.2 Risk management

1) develop a risk register for all major projects and stipulate that the maintenance of this is mandatory;
2) develop database(s) to record historical tendered prices and causes/amount of escalation post contract award. Improved cost estimation procedures are needed in their own right but also form an integral part of risk management;
3) employ complementary methods of risk identification, including NCMNR's Risk Index and developing a database of project risks to inform risk exposure on future, comparable projects and the effectiveness of risk response measures;
4) extend NCMNR Risk Management Guidebook to include guidance on cost QRA.

7.2.3 Market Competition

1) review barriers to entry, especially to introduce measures to encourage more foreign contractors to enter and stay in the Romanian market. Reverting of the recent trend to advertise only in Romanian language would be one such factor;
2) consider the bundling of projects to reduce project numbers and attract larger suppliers.
3) manage demand by smoothing infrastructure spending to avoid peaks and troughs that may exacerbate capacity problems;
4) improve and extend (to include the rail sector) the use of construction cost indices.

7.2.4 Institutional measures

The achievement of these changes is likely to require significant investment to provide the necessary manpower resources and to implement institutional and process development. This is likely to take some time. We therefore believe that there is a need to develop a programme for the institutional changes, to estimate the costs of any changes and to ensure that funds are available for the transition.

Appendix A

Proposed simple form of Price Adjustment Clause

Appendix A: Simpler approach for a price adjustment clause for use within local contract forms in Romania

Adjustment for changes in cost

1. The amounts payable to the Contractor on individual interim and final payment certificates issued pursuant to the Contract, shall be adjusted for the rise and fall in the cost of labour, materials and equipment inputs by the addition or deduction of amounts calculated in accordance with the following Price Adjustment Formula:

Fn = 0.10 + 0.90 x (Cn/Co)

Where:

Fn is the Current Adjustment Factor to be applied to the Effective Value of the payment certificate in respect of work carried out in "Period n", this period being based on monthly payment certificates.

0.10 is the non-adjustable portion

0.90 is the adjustable portion

Cn is the current cost index for road infrastructure

Co is the base cost index for road infrastructure

2. To the extent that full compensation for the rise and fall in the cost of labour, materials and equipment inputs is not fully covered by the provisions of this or other clauses, the Contract Price shall be deemed to have included contingency amounts to cover other fluctuations in costs.

3. Cost adjustment shall be calculated on the Effective Value based on the amount of the individual interim payment certificate excluding:

i) the deduction or repayment of retention

ii) any credits or debits for materials and Plant on site

iii) any advance payment or repayment of the advance

iv) any amounts for nominated sub-contractors

v) the value of any dayworks, variations, and other items based on actual costs or current prices

vi) the amount of any cost adjustment made pursuant to this clause

4. Cost indices shall be those published by the Latvia National Statistics Office and for the purpose of this clause:

a) Base Cost Index – shall be the quarterly index applicable at the date for submission of tenders. Where monthly cost indices are published, the monthly index applicable 42 days prior to the date for receipt of tenders shall be substituted for the quarterly cost indices.

b) Current Cost Index – shall be the quarterly index applicable to the sooner of the following events:

- The last day of the period to which the payment certificate relates; or
- The due date for completion (or extended date for completion); or
- The date of issue of the Taking-over of Final Acceptance certificate

But if the Contractor fails to complete within the time for completion the Current Index shall be the quarterly index applicable to whichever is the more favourable to the Employer of the following events:

- The last day of the period to which the payment certificate relates; or
- The due date for completion (or extended date for completion)

Where monthly cost indices are published, the monthly index applicable 42 days prior to the sooner of the above events shall be substituted for the quarterly cost indices.

5. Where a current cost index is not immediately available, the Engineer shall determine a provisional index for the issue of he interim payment certificates until such time as the relevant current index is available. The cost adjustment shall then be recalculated based on the current index.

6. Determination of the final Contract Price shall give effect to the net increases and decreases calculated in accordance with this clause.

Appendix B

Risk Management Guidelines

B1 Introduction

This appendix constitutes a risk management *Guideline* with which to compare current practice. It therefore enables any deficiencies to be highlighted and potential improvements to be advanced. The *Guideline* comprises an amalgam of proven risk management practices worldwide, which can sensibly be tailored to EC-funded transport investment projects.

B1.1 Purpose

The *Guideline* provides a benchmark with which to compare risk management practice in the participating countries. Because of the large number of countries involved in the CFPM commission, guidance is necessarily general. Further, it is not prescriptive; not all techniques being suited to each country. Rather, the *Guideline* provides a toolkit from which to select the most appropriate risk management techniques and tools to use, given the circumstances of an individual project.

B1.2 Scope

The *Guideline* is intended to cover risk management practice at all project lifecycle phases, from appraisal of concept designs to project completion. It allows for the assessment and management of capital cost risk only. Specifically, it addresses the following cost risk types:

- Direct cost risks;
- Programme delay cost risks;
- Cost estimating uncertainties.

B2 Guideline Basis

This Guideline has drawn on risk management guidance and practice, primarily from the United Kingdom (UK), but also from North America, Australasia and the participating countries. Key reference documents are listed in *References*.

The Guideline is not intended to be prescriptive. Rather, it provides the reader with a project risk management structure, and a selection of proven risk management tools and techniques, which would provide for effective risk management on projects seeking and using funding from the EC.

B3 Definitions

Avoid:	Eliminating threat usually by eliminating the cause (e.g. clarification of requirements & objectives, acquiring appropriate expertise, doing project in a different way);
Base Cost Estimate:	The base cost represents the cost that can reasonably be expected if the project materialises as planned. It typically comprises quantities and unit rates;
Correlation:	Two input distributions are correlated when their samples are related (i.e. the value sampled for one distribution affects the value sampled for the other);
Discipline:	Refers to technical workstreams (e.g. pavement, signalling, environmental, geotechnics etc.);
Residual Exposure:	Refers to the level of risk exposure having taken account of all the risk response measures explicitly employed in the project preparation ;
Opportunity:	A risk event with a positive outcome;
Pre-Mitigated Exposure:	Refers to the level of risk exposure taking account of existing risk response measures only. In other words, it is an assessment of the current level of risk exposure;
QRA:	Quantitative Risk Analysis: includes modelling and computer simulations in order to quantify cost and programme risk exposure
Risk:	Refers to a chance event which, if it occurred, could have a negative (i.e. threat) or positive (i.e. opportunity) effect on project costs. Risk is typically the product of probability (of the risk occurring) and effect (i.e. consequence were the risk to occur);
Secondary Risks:	Risks which arise as a result of implementing a risk response measure;
Threat:	A risk event with a negative outcome;
Transfer:	Allocating risk ownership to another party, for example, via a contractual transfer;
Treat:	Reduce probability of occurrence (e.g. by using proven technology). Treatment may be by adopting more than one defensive strategy for key failure mechanisms (i.e. defence in depth);
Tolerate:	Either actively (e.g. by developing contingency plan to execute should the risk occur, risk monitoring and reporting, risk reviews and updates) or passively (e.g. by accepting financial losses were risk events to occur);
Uncertainty:	Refers to possible errors in cost, income and schedule predictions owing to lack of information. Uncertainties typically reduce with more detailed designs and associated cost plans.

B4 Guideline Structure

B4.1 Overview

Each of the following subsections addresses an individual element within the *management systems* approach to risk, namely:

1. Risk management planning
2. Risk identification
3. Qualitative risk assessment
4. Quantitative risk assessment
5. Risk response planning
6. Risk monitoring and control

It should be noted that, although these elements are typically applied sequentially, they can also be applied concurrently (e.g. risks are monitored in parallel with new risks being identified and assessed) and iteratively (e.g. mitigation plan for one risk may yield another, secondary risk).

It should be noted that, to be effective, risk management needs to be an integral part of the overall system of project management and not just a bolt-on exercise. The application of risk management on transport investment projects should be inextricably be linked to design development, to procurement, to stakeholder management and to project control functions (e.g. cost estimating, cost management, contract management, planning). Consequently, an open communication process, involving the project's key stakeholders (e.g. state ministries, design consultants, contractors, statutory consultees, land owners etc.), should be actively encouraged to provide for this level of integration and engagement with the risk management process.

B4.2 Risk Management Planning Guidance

Risk management planning is the systematic process of deciding how to approach, plan and execute risk management activities throughout the life of a project. The exercise should clarify:

- Risk management roles and responsibilities both within and outside the beneficiary's organisation;
- The level of cost risk exposure the beneficiary is prepared to tolerate;
- Risk management techniques and tools to be used;
- The scheduling of risk management activities in relation to the overall project plan.

The risk management plan (RMP) should be updated following award of construction contract to:

- Undertake a survey of the signed contractual documentation to identify which risks have been transferred or retained;
- Document which risks have yet to be resolved as at contract execution;
- Consider potential residual risks;
- Understand risks associated with failing to manage the contract effectively;
- Consider possible changes to the contractual arrangements to manage identified risks more cost-effectively.

B4.3 Risk Identification Guidance

Risk identification should be viewed as an iterative process because new risks may become known and previously identified risks may drop out, as the project progresses through its lifecycle. The frequency of iteration can vary, but should be linked to hold points in the project schedule (e.g. concept design, business case, preliminary design etc.). Ideally, the beneficiary's project team should be involved in the process so that they can develop and maintain a sense of ownership of, and responsibility for, the risks and associated risk response plans. Stakeholders from outside the project team may be able to provide additional objective information.

There are many recognised risk identification techniques, including creative workshops, interviews (with discipline leaders) and reviews (of documentation and databases). In each case, it is important to elicit information from all key project stakeholders. Information can be gathered using:

- Risk guidewords or checklists;
- Knowledge of comparable historical projects. This knowledge may have been recorded in a "lessons learned" database, historical risk database or historical risk registers.

It is important to describe each risk correctly. A risk has a cause and at least one cost consequence. In order to assess risk exposure and respond appropriately, both cause and consequence need to be clearly stated.

B4.4 Qualitative Risk Assessment Guidance

Once cost risks have been identified, their significance should be gauged in order to decide on actions. This is done by multiplying the probability and the cost impact values. To inform these values, project-specific risk classification schemes should be agreed by beneficiaries

An example project risk classification scheme is shown in Table B1. The quantified values are not fixed and should be determined based on both the estimated project base cost and the stakeholders' predisposition to risk. The probability or percentage bands (Columns 1 & 2) equate to a value (Column 3). Judgements need to be made as to the most appropriate probability band for each identified risk and the 'value' recorded in the risk register. The same is true of assessing risk severity: the quantified band (Column 5) is used as guides for assigning the appropriate value (Column 6).

Assessments should initially be made of each risk's pre-mitigated exposure (see B3 *Definitions*). Additional assessments should then be made to account for the risk reduction potential afforded by any additional risk response measures (i.e. mitigated risk exposure). It should be noted, however, all risk response measures should be examined in depth to confirm their feasibility and risk control potential, relative to cost, before being implemented. Mitigated risk should therefore represent target levels of risk exposure, whereas pre-mitigated risk represents current levels of risk exposure. To illustrate the difference between pre-mitigated and mitigated risk exposure, the latter could account for the contractual transfer of ground risk to a contractor, whereas the pre-mitigated assessment of exposure would assume the beneficiary owns the risk.

Table B1 – Example Risk Classification Scheme

Probability of Occurrence (P)			Impact on the Project (I)		
Scale	Range	Value	Scale	CAPEX Range	Value
Rare	0 – 5%	1	Insignificant	<€100k	1
Low	6 - 20%	2	Minor	€100k -€1m	2
Medium	21 - 50%	3	Moderate	€1m - €3m	3
Likely	51 - 80%	4	Significant	€3m - €6m	4
Almost Certain	> 81%	5	Serious	> €6m	5

Once risks have been assessed qualitatively, they can be mapped onto a risk matrix to illustrate the distribution of risk exposure. Table B2 shows an example risk matrix for highlighting the more significant risks; the different coloured regions representing varying levels of risk exposure and hence tolerability. The coloured regions should be agreed at the risk management planning stage to reflect the importance a beneficiary attaches to different levels of risk .The matrix can therefore be used to prioritise risks for more detailed schedule Quantitative Risk Analysis (QRA) and risk response planning. It presents values of risk exposure (RE) for combinations of likelihood and severity from the *Value* column in Table B1.

Table B2 – Example Probability-Impact Risk Matrix

		Risk Likelihood				
		Rare 1	Low 2	Moderate 3	Likely 4	Almost Certain 5
Risk Severity	Serious 5	5	10	15	20	25
	Significant 4	4	8	12	16	20
	Moderate 3	3	6	9	12	15
	Minor 2	2	4	6	8	10
	Insignificant 1	1	2	3	4	5

B4.5 Quantitative Risk Assessment Guidance

B4.5.1 Introduction

Cost risk quantification generally follows qualitative risk assessment. It requires risk identification. The qualitative and quantitative processes can be performed separately or together.

There are several quantitative techniques, whose reliability can vary. The following paragraphs briefly mentions three commonly-used techniques:

- Expected Monetary Value (EMV)
- Quantitative Risk Analysis (QRA)
- Optimism Bias (OB)

B4.5.2 Expected Monetary Value (EMV)

EMV estimates a single monetary value, were a risk to occur, and weights it by the probability of its occurrence. Whilst it provides a probabilistic assessment of cost risk, it does not account for every possible value each cost variable could take.

B4.5.3 Quantitative Risk Analysis (QRA)

Unlike EMV, QRA enables each variable to be represented by a probability distribution function rather than a single value. It allows impact ranges (e.g. minimum, most likely and maximum), which should be relative to base cost estimates, to be described by probability distributions. Risk analysis software programs (e.g. Crystal Ball, @RISK) can then combine the risks and uncertainties, and provide an overall cost risk distribution for a project. Also, it also enables correlation and interdependencies to be modelled.

QRA is increasingly being used worldwide, especially when appraising capital investment projects. Based on the level of risk that the client is willing to accept, beneficiaries can make a more informed choice of budget values to use for funding and for controlling the project. It can offer reliable answers to the following questions:

- If there is budget overrun, what is the likelihood of such an event (see Figure B1)?
- What is the level of exposure associated with any overrun that may occur (see Figure B1)?
- Where do the individual risks lie that need to be controlled to avoid overrun (see Figure B2)[7]?

[7] A regression coefficient of 100% or -100%, indicates a 1 or -1 standard deviation change in the output from a 1 or -1 standard deviation change in the input. In other words, it indicates the degree of correlation between the two sets of values: +100% being highly correlated, 0% no correlation, -100% inversely correlated

Figure B1 – Example Cumulative Cost Risk Distribution

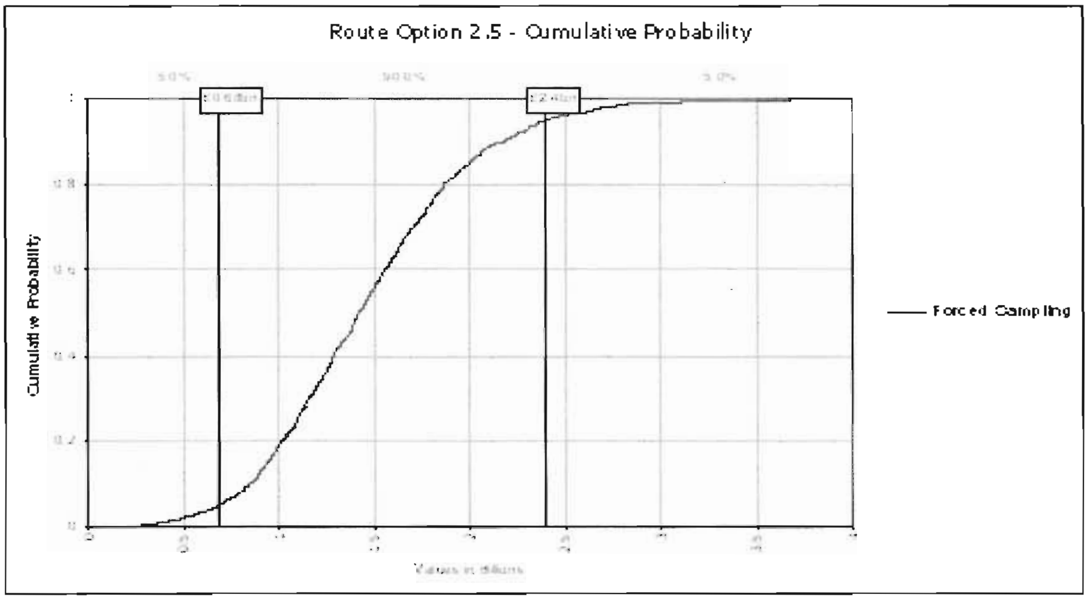
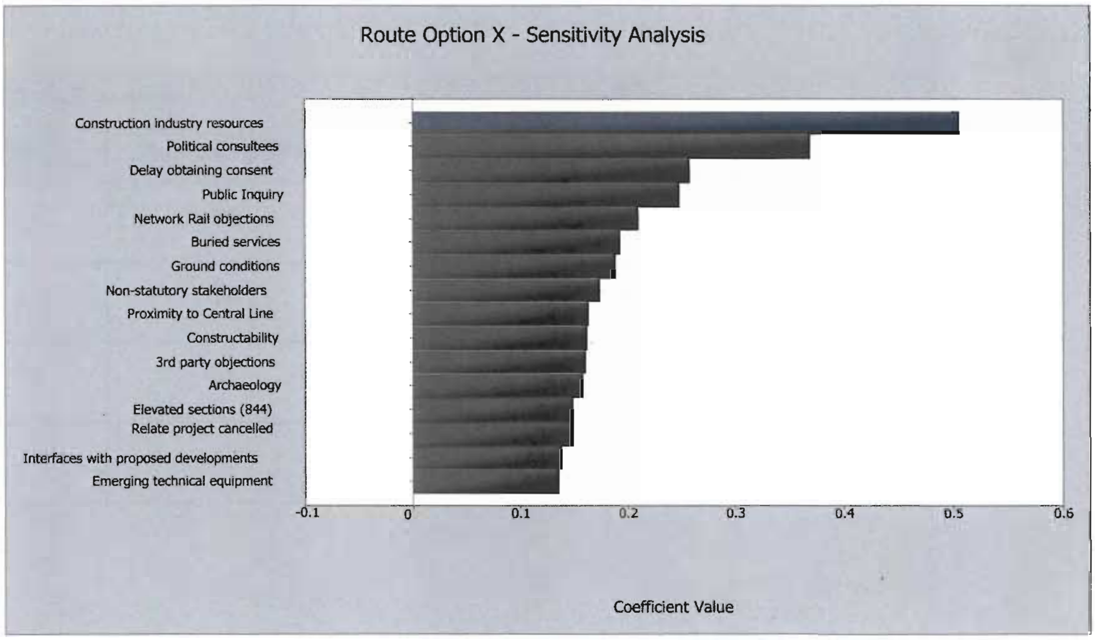


Figure B2 – Example Sensitivity Analysis



B4.5.4 Optimism Bias (OB – CFPM Task 9 refers)

For the last five years in the United Kingdom, publicly procured projects have been obliged to account for Optimism Bias (OB), defined as the historical tendency for projects to underestimate project costs. OB is supposed to complement Monte Carlo QRA. It is a percentage uplift on the sum of the base estimate and Monte Carlo QRA value. The percentage uplift is estimated based on empirical data from comparable projects. For example:

Base Cost Estimate	*€70m*
QRA (mean value)	*€12m*
Optimism Bias (+15%)	
Total Scheme Cost	*€82m x 1.15 = €94.3m*

Treasury Green Book[8] and the Department for Transport's (DfT) related procedure[9] respectively (see *References*). These uplift percentages are applied to projects of the same type. Upper bound values should be assumed at early project stages. Thereafter, reductions are justified to account for more design definition, more detailed cost estimating and QRA.

The types of transport schemes under the direct and indirect responsibility of the DfT have been divided into a number of distinct groups where the risk of cost overruns within each of the groups can be treated as statistically similar. For each of the groups, a reference class of completed transport infrastructure projects has been used to establish probability distributions for cost overruns for new projects similar in scope and risks to the projects in the reference class. Based on this, the necessary uplifts to ensure that the risk of cost overrun is below certain pre-defined levels have been established. For example, (from Table B4), an uplift percentage of 32 percent should be applied to the base cost of a roads scheme if the sponsor wants no more than a 20 percent chance of the sum total (i.e. base cost X 1.32) being exceeded.

Task 9 of this CFPM commission has involved collecting historical cost data, from all participating countries, from three points in a project's lifecycle, namely appraisal, contract award and completion. The output is a series of uplift percentages to be applied from project appraisal to contract award. Additional data points still need to be collected to provide reliable country-specific uplifts.

Table B3 – Extract from UK HM Treasury Capital Expenditure Optimism Bias Uplifts[8]

Project Type	Optimism Bias (%)	
	Upper Bound	**Lower Bound**
Standard Buildings	24	2
Non-standard Buildings	51	4
Standard Civil Engineering	44	3
Non-standard Civil Engineering	66	6

[8] UK Her Majesty's (HM) Treasury *Supplementary Green Book Guidance – Optimism Bias*

Table B4 - Extract from UK Department for Transport Capital Expenditure Optimism Bias Uplifts[9]

Category	Types of projects	Applicable optimism bias uplifts	
		50% percentile	80% percentile
Roads	Motorway Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided buses on wheels	**15%**	**32%**
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	**40%**	**57%**
Fixed Links	Bridges Tunnels	**23%**	**55%**

B4.5.5 Contingencies

Tables B5 and B6 provide worked examples of the application of physical and price contingencies in a financial budget and the impact on outturn cost of delays to the schedule and higher than expected rates of inflation.

Three cases are shown, Case A, the Base Case where construction takes place as planned after one year. In Table B5, where annual inflation occurs at the forecast level, this project comes out on budget. For Case B, there is a slippage in time of one year to the construction schedule. The total cost of inflation is therefore more than was allowed for in the budget and a small cost overrun of 6% is seen at outturn. In Case C, the schedule slips further by two years. This results in a larger cost overrun of 12%.

Table B6 shows the effect on cost overruns of higher than expected inflation in combination with delays to the schedule. The price contingencies allowed for inflation of 6% per annum, however actual inflation was 10%. Even in Case A, where the project takes place on time this results in a cost overrun of 9%. In Case B, the delay of a year results in a much larger overrun of 20% and in Case C a further year of delay causes an overrun of 31% compared with the budget.

This therefore shows the importance of making adequate price contingency allowance in the project budget for inflation and of being realistic when planning the timescale for construction.

[9] The British Department for Transport - *Procedures for Dealing with Optimism Bias in Transport Planning* Guidance Document, June 2004

Table B5: Example of contingency calculation and outturn costs with delays to the construction schedule (million Euro)

Physical Contingency	10%
Price Contingency per annum	6%
Actual inflation per annum	6%

Year	2010				Annual spend 2011	2012	2013	2014	2015			
Project	Estimated Cost 1	Physical Contingency	Cost + Physical Contingency							Project Budget 3	Outturn Cost 4	Cost Overrun 5
A	10.0	1.0	11.0	Construction cost 2	2.2	4.4	4.4			12.5	12.5	0%
				Price contingency	0.1	0.5	0.8	0.0	0.0			
				Actual inflation	0.1	0.5	0.8	0.0	0.0			
B	10.0	1.0	11.0	Construction cost 2		2.2	4.4	4.4		12.5	13.3	6%
				Price contingency	0.1	0.5	0.8	0.0	0.0			
				Actual inflation	0.0	0.3	0.8	1.2	0.0			
C	10.0	1.0	11.0	Construction cost 2			2.2	4.4	4.4	12.5	14.1	12%
				Price contingency	0.1	0.5	0.8	0.0	0.0			
				Actual inflation	0.0	0.0	0.4	1.2	1.5			

A Base Case, start construction after 1 year
B Case B, slippage of one year
C Case C, slippage of two years

1 Estimated cost for project at appraisal excluding contingencies
2 Cost including physical contingencies
3 Total budget required for project with physical and price contingencies included
4 Construction cost plus actual cost of inflation
5 Percentage by which outturn cost exceeds project budget

Based on: Scott Wilson (2007) Latvia Road and Rail Construction Inflation Study

Table B6: Example of contingency calculation and outturn costs with higher than forecast inflation (million Euro)

Physical Contingency	10%

Price Contingency per annum	6%

Actual inflation per annum	10%

					Annual spend							
Year		2010			2011	2012	2013	2014	2015			
Project	Estimated Cost 1	Physical Contingency	Cost + Physical Contingency							Project Budget 3	Outturn Cost 4	Cost Overrun 5
A	10.0	1.0	11.0	Construction cost 2	2.2	4.4	4.4			12.5	13.6	9%
				Price contingency	0.1	0.5	0.8	0.0	0.0			
				Actual inflation	0.2	0.9	1.5	0.0	0.0			
B	10.0	1.0	11.0	Construction cost 2		2.2	4.4	4.4		12.5	15.0	20%
				Price contingency	0.2	0.9	1.5	0.0	0.0			
				Actual inflation	0.0	0.5	1.5	2.0	0.0			
C	10.0	1.0	11.0	Construction cost 2			2.2	4.4	4.4	12.5	16.5	31%
				Price contingency	0.1	0.5	0.8	0.0	0.0			
				Actual inflation	0.0	0.0	0.7	2.0	2.7			

A Base Case, start construction after 1 year
B Case B, slippage of one year
C Case C, slippage of two years

1 Estimated cost for project at appraisal excluding contingencies
2 Cost including physical contingencies
3 Total budget required for project with physical and price contingencies included
4 Construction cost plus actual cost of inflation
5 Percentage by which outturn cost exceeds project budget

Based on: Scott Wilson (2007) Latvia Road and Rail Construction Inflation Study

B4.6 Risk Response Planning Guidance

As with risk assessment, the required level and type of risk response should be determined by risk exposure. There are four broad strategies of responding to negative risks or threats:

- **Avoid**: involves changing the project plan to eliminate the risk or to protect the project objectives from its impact. Some risk causes that arise early in a project can be dealt with by clarifying requirements, obtaining information, improving communications, or acquiring expertise. Reducing scope to avoid high-risk activities, adding resources or time, adopting a familiar approach instead of an innovative one, or avoiding an unfamiliar contractor are examples of risk avoidance.
- **Transfer**: seeks to transfer the impact of a risk to a third party, together with ownership of the response. Transferring the risk does not eliminate it, but simply gives another party responsibility for its management. It invariably involves payment of a risk premium to a party taking on the risk. Risks can be transferred via procurement types, contractual clauses, pricing mechanisms, insurance, performance bonds, warranties and guarantees. However, in achieving an optimal risk distribution, there are several considerations the beneficiaries must make. They are, that a risk should only be given to a body who:

  a. Has been made fully aware of the risks they are taking;

  b. Has the greatest capacity to manage the risk effectively and efficiently;

  c. Has the resources available to cope with the risk were it to occur;

  d. Has the necessary risk appetite to own the risk;

  e. Has been given the chance to charge an appropriate premium for owning it.

  By not making these considerations, the beneficiaries would merely be gaining the illusion of risk transfer, since it is likely that the risk will be transferred back to them in the form of higher risks, risk premiums and project problems. To ensure that this does not happen, beneficiaries should develop risk allocation matrices that identify risks and distinguish the party most capable of assuming a particular risk. Care should be taken to ensure these matrices are project-specific since the majority of projects have a different array of risks, which need to be thoroughly evaluated and understood.
- **Treat**: reduce risk exposure either by reducing the probability or reducing the severity of a risk to below an acceptable threshold. Prevention is more effective than trying to repair or reduce the consequences after the event has occurred (i.e. mitigation). Examples include amending the design, or using different materials or different methods of construction.
- **Tolerate**: where risks cannot economically be transferred, avoided or treated, they can be tolerated either actively or passively. The former centres on developing a contingency plan (e.g. cost and schedule reserves) to draw on should a risk occur. The latter requires no action, leaving the project team to deal with the risks as they occur.

Once the most appropriate strategy has been determined, the actual risk response measure, with which to realise the chosen strategy, needs to be designed. Before implementing any risk response measure, a robust evaluation of its *cost* relative to its risk reduction potential should be made.

B4.7 Risk Monitoring and Control Guidance

Risk monitoring is an iterative process that should occur throughout the life of a project. It comprises four activities:

1. Monitoring current risks: To determine when and if a risk response should be initiated; the effectiveness of the response so that it can be changed, if necessary, before a problem develops; when a response has been successful and the risk can be closed;
2. Identifying new risks: As a result of requirements changes, budget and programme changes, or simply a better understanding of the project. The project manager or risk manager should judge whether a formal workshop is necessary to consider risks associated with these changes. Notwithstanding, all project team members are responsible for reporting project changes so that project management can make that decision;
3. Conducting periodic reviews: Project risk should be agenda item at all team meetings. Risk exposure may change during the life of the project. Any changes may require additional qualitative or quantitative assessment;
4. Periodically reassessing risk exposures: See 3 above.

Activities one and two are on-going events. Items three and four are scheduled events that should be tied to key events in the project programme. The frequency of risk monitoring, and the responsibility for it should be specified in the project risk management plan.

A project risk register should be the primary means of recording risk information and monitoring risk exposure. Table B7 provides more explanation of the function of typical register fields/columns. It should:

- Record all identified risks and their associated assessments;
- Include necessary risk response plans and responsibilities;
- Indicate the status of all risks;
- Be structured so as to allow risks to be filtered and sorted according to, for example, type, project phase, discipline, (sub) project, exposure or owner.

The recording of historical risk-related information is becoming increasingly common practice. It can reliably inform future, comparable projects of:

- Risks to consider;
- Their likely probability and consequence (qualitative and quantitative assessments);
- Effective (and ineffective) risk response measures;
- Other lessons learned.

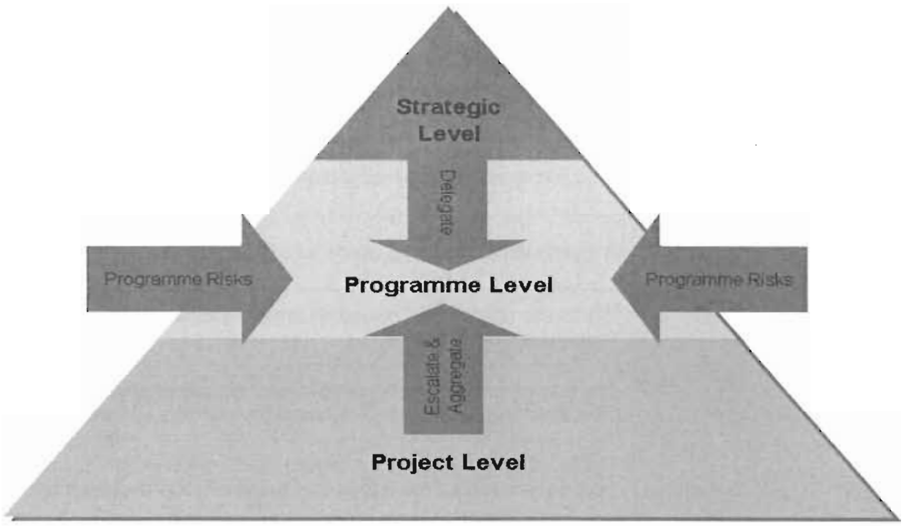
Table B7 - Typical Project Risk Register Fields/Columns

Risk Register Field	Data Input Advice
Risk ID	A unique identifier for each risk.
Date Raised	Date when risk was first identified
Opportunity or Threat	Indicates whether the risk results in negative (i.e. threat) or positive (i.e. opportunity)
Risk Category	Enables risks to be grouped, sorted and filtered to help risk reporting
Risk Title	A keyword, or short phrase to summarise the risk event
Cause	A clearly stated initiating event, which can result in one or more consequence.
Consequence	States the effect of the cause on project success criteria (e.g. CapEx, Programme or Reputation).
Risk Owner	The person or organisation that is best placed to ensure the risk is handled correctly. NB: This doesn't necessarily infer any contractual liability.
Pre-Response / Current Assessment	The initial assessment of probability and impact accounts for the benefit of existing risk control measures (i.e. those already implemented)
Probability	The value should cover the probability of the initiating event AND the probability of the initiating event resulting in the consequence.
Impact	The assessment of 'impact' should be measured in terms of the most likely impact magnitude were the risk to occur.
Risk Score	The industry standard for calculating risk exposure is Probability x Impact, although an additive scheme is sometimes used.
Risk Response Strategy	This cell is restricted to a list of terms to describe at a high level what your specific actions (recorded in the next cell) are trying to achieve.
Response Control Action (RCA)	This column is to record specific actions to affect a risk's probability and/or impact.
Action Owner	Allocates responsibility for developing and action an RCA.
Action Due Date	States the target completion date for and RCA
Action Status	Options are 'Proposed', 'Sanctioned' 'Rejected' 'In progress', 'Complete'
Residual Assessment	Assess risk exposure assuming ALL identified RCA's are implemented. NB: if some but not all RCA's are implemented the assessment is assumed 'Current'.
Probability	The probability of the initiating event resulting in the stated consequence, given the implementation of ALL RCSs
Impact	The consequence of a risk event, given implementation of ALL RCAs.
Risk Score	Residual Risk is calculated in the same way as Current Risk.
Comments	To provide an auditable trail and a basis for recording assessment scores & related assumptions.
Status	To indicate the current status of a risk (e.g. open, closed)

B4.8 Programme Risk Management Guidance

Programmes need to account for three potential sources of risk, as is illustrated in Figure B3. Risks could arise from its component projects, from governing organisational strategy or from the programme itself. The scope of programme risk management must include all three sources of risk.

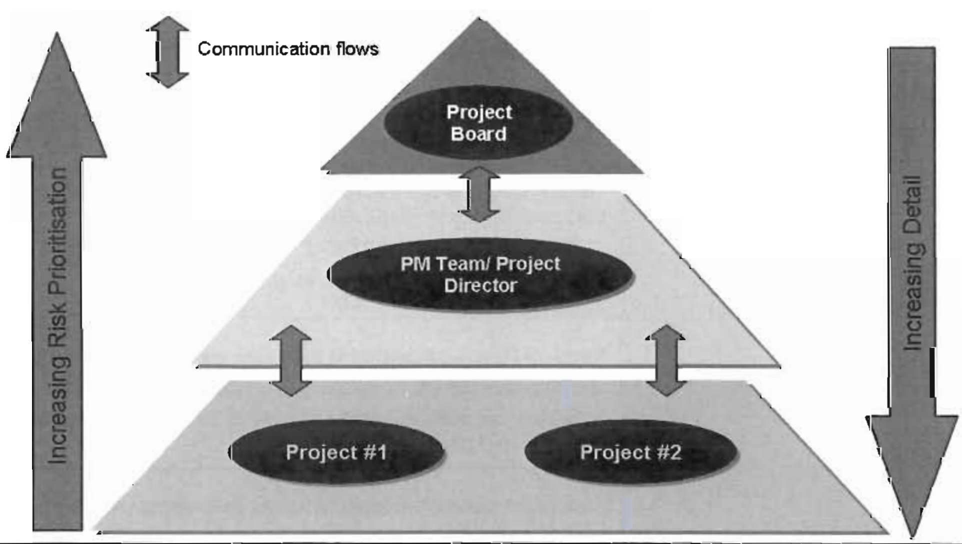
Figure B3 – Sources of Programme Risk



The management of programme risks should be both implicit and explicit. The former refers to the inherent structure of the programme itself. This can be effected via project selection. In other words, projects are selected in order to maintain risk exposure at a level which is consistent with the risk appetite of the beneficiaries, while attempting to deliver the required infrastructure improvements. Implicit programme risk management can also be realised by phasing the delivery of component projects, for example to suit prevailing market conditions.

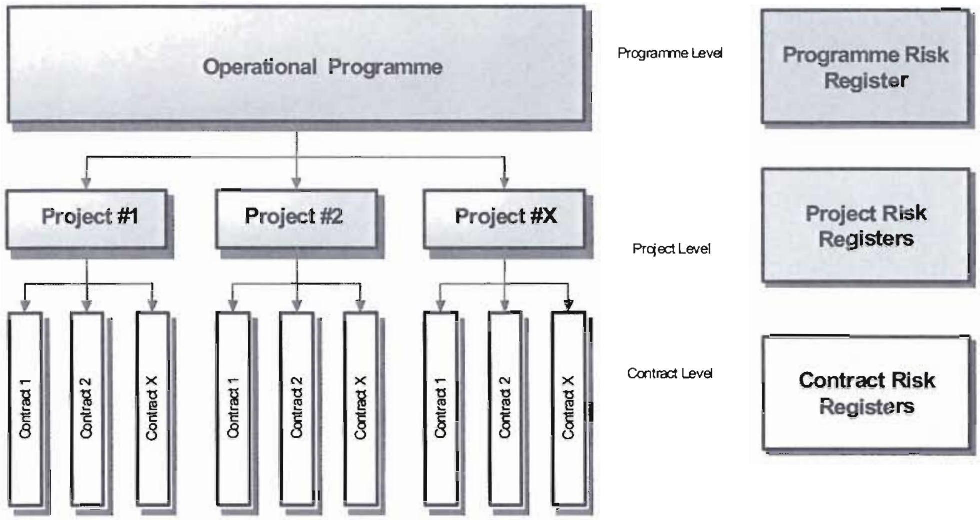
Explicit programme risk management requires a structured process analogous to the project risk management approach (i.e. identify, assess etc.). There are some important differences, however, most notably establishing criteria and protocols for communicating risks within the programme organisation for reporting and ownership (see Figure B4)

Figure B4 – Programme Risk Communication



The need to record and maintain risk-related information at different tiers within the programme organisation is also fundamentally important. This has implications for the selection of appropriate risk management computer tools (e.g. ARM, Predict!), which allow a hierarchy of risk registers to be built and maintained within the organisation.

Figure B5 – Risk Register Hierarchy



References

References

[1] Romania Roads and motorway Development. Final report. March 2007

[2] Transport Sector, Romania Institutional Modernisation. Final report to EIB. July 2008.

[3] UK HM Treasury Green Book – *Appraisal and Evaluation in Central Government,* March 2003

[4] APM Body of Knowledge - *Prioritising Project Risks – A Short Guide to Useful Techniques*, 2008

[5] AS/NZS ISO 31000:2009, *Risk management - Principles and guidelines*

[6] UK Department for Transport (DfT) guidance document 58924, Issue 1 – *Procedures for Dealing with Optimism Bias in Transport Planning*, June 2004

[7] Latvia Procedure Nr.14 – *Risk Management Procedure of EU Structural Funds and Cohesion Fund Projects in the Ministry of Transport*, May 2007

[8] Romania NCMNR, Draft - *Attachment 4, Risk Management Guidebook – Clarification Note & Procedural Clarifications*

[9] UK British Standard BS6079-3:2000 – *Project Management, Part 3: Guide to the Management of Business Related Project Risk*

[10] Project Management Institute Global Standard – *Practice Standard for Project Risk Management*, July 2009

[11] UK Office of Government and Commerce - *Management of Risk: Guidance for Practitioners,* March 2007