OPERATIONAL PROGRAMME
TRANSPORT

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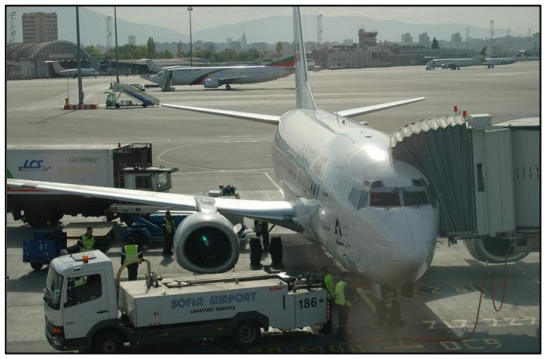
MINISTRY OF TRANSPORT, INFORMATION TECHNOLOGY AND COMMUNICATIONS REPUBLIC OF BULGARIA

PREPARATION OF A GENERAL TRANSPORT MASTER PLAN FOR BULGARIA



AECOM

Final Report
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Table of Contents

Tables

Figures

1 Introduction

1 Introduction

1.1 Bulgaria General Transport Master Plan

The Bulgarian General Transport Master Plan was commissioned by the Ministry of Transport of the Republic of Bulgaria in May 2008. The project was funded jointly by the Bulgarian Government and through Priority Axis V of the Operational Programme on Transport 2007-2013 (OPT). This is one of the seven operational programmes of the Republic of Bulgaria which are financed by the Structural and the Cohesion Funds of the European Union. The project was undertaken by AECOM a global provider of professional technical and management support services.

1.2 Purpose of Study

The main objective of the General Transport Master Plan project is clearly set out in the Technical Specification prepared by the Bulgarian Ministry of Transport as being:

"the establishment of a strategic and coherent base of technical data, transport models and multimodal technical studies for project identification for long and medium term investment programming in the transport sector in Bulgaria. These technical studies should possess a high degree of consistency, through the appropriate elaboration of a transport master plan".

The primary goals of the study can be summarised as follows:

- Ensure the mobility of persons and goods under the best possible social and safety conditions, while supporting the achievement of the Community's objectives, particularly in regard to competition and environment, and contributing to the strengthening of economic and social cohesion;
- Ensure the planning of high-quality infrastructure on acceptable economic terms;
- Include all modes of transport, taking into account their relative advantages;
- Allow the optimal usage of existing infrastructure capacity;
- Encourage operational harmonization and intermodality between the different modes of transport;
- Be feasible on a macro-economic level; and
- Contribute to the implementation of transport activities conformable to environmental requirements.

The project objectives and goals also need to be set in the context of wider European Union (EU) and Bulgarian transport policy.

The EU's objectives for transport are set out in the 2001 White Paper "European Transport Policy for 2010: Time to Decide" with the key theme of achieving:

"mobility for all citizens that is sustainable in economic, social and environmental terms".

As a Member State, Bulgaria will be expected to accept EU priorities and demonstrate compliance with them to achieve EU funding for the projects identified in the Master Plan.

It is also essential that the Master Plan meets the specific aims of the Bulgarian Government. These are set out in the National Strategic Reference Framework for the 2007-2013 programming period. This sets out the vision for development of the country as an EU member state as follows:

"by 2015 Bulgaria should become a competitive EU country with high quality of life, incomes and social awareness".

This vision will be realised through the achievement of two medium term goals:

- Strengthening the competitiveness of the economy to achieve high and sustainable growth; and
- Developing human capital to ensure higher employment, income and social integration.

Improved transport can play a key role in meeting these goals.

The "National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan for the Period 2006-2015" set out the Government's investment policy for this period to meet the overall priority of improving basic infrastructure. In the transport sector, the strategy sets out 8 priorities:

- Build and develop the key transport infrastructure connections of national, cross-border and European importance and improve the interoperability of the main railway lines;
- Develop the national road infrastructure and integrate it into that of the EU Member States;
- Develop and improve the road network and adjust it to European norms and standards;
- Optimise the capacity and efficiency of the existing and new infrastructure;
- Modernise the infrastructure of the River Danube and sea waterways;
- Improve the conditions for navigation and promotion of intermodal transport;
- Develop and modernise airports and adjust them to the requirements of the European Union in the field of protection of the environment; and
- Promote public-private partnerships.

A stated, the General Transport Master Plan has been funded by the Operational Programme for Transport. The goal of the OPT is the development of railway, road and waterway infrastructure, as well as stimulation of development of mixed transport in accordance with the transport policy of the European Union and the established requirements for development of the Trans-European transport network in order to achieve stability of the Bulgarian transport system.

A specific feature of the OPT reflected in the anticipated outcomes of the General Transport Master Plan is the advanced selection and prioritisation of an indicative list of infrastructure projects envisaged for financing under the programme.

1.3 Final Project Report

The outputs from the General Transport Master Plan comprise 13 Key Reports and a Final Report covering all stages, activities and findings from the project.

This is the Master Plan Study **Final Report**. It provides a summary of all the work undertaken by the Consultants in formulating the Master Plan. Full details of the individual elements of the project are contained in the 13 Key Reports a schedule of which is provided in Appendix A.

1.4 Structure of Report

The remainder of this report is divided into nine further chapters:

- Chapter 2 – analysis of the existing transport system in Bulgaria.
- Chapter 3 – development of the transport models to help identify and evaluate transport options.
- Chapter 4 – current and future transport demand.
- Chapter 5 – weaknesses and gaps in the transport system
- Chapter 6 – identification of a long list of options that have the potential to overcome the weaknesses and gaps.
- Chapter 7 – the methods used to appraise and evaluate the options and to determine whether they are likely to be successful, meet the objectives of the Master Plan and provide value for money.
- Chapter 8 – the outcomes from the appraisal including recommendations on options to be carried forward in to the Master Plan.
- Chapter 9 – the content of the Master Plan and its evaluation. This includes a summary of the Strategic Environmental Assessment and the standpoint of the Ministry of Environment and Water.
- Chapter 10 – strategies for delivery of the Master Plan including; asset maintenance, implementation and funding, monitoring and evaluation, and human resources.

There are three appendices which provide supporting information:

- Appendix A – provides a schedule of the Key Reports;
- Appendix B – describes the development of the transport models used for demand forecasting and to support the quantitative appraisal of options; and
- Appendix C – provides a list of acronyms and abbreviations used in the report.

1.5 Sources of Data

The overall study and the content of this report in particular, rely very heavily on information and data that is available from published sources, technical reports and data provided to the consultants as a direct request for information from consultees and stakeholders. In each case we have provided the source of any data or information presented.

Where appropriate we have attempted to independently verify both the logic and accuracy of all quoted data. However, this has not always been possible and therefore we are unable to guarantee the accuracy of all information within the report.

2 Analysis of the Existing Transport System

2 Analysis of the Existing Transport System

2.1 Introduction

Before being able to make recommendations on priorities for transport investment for Bulgaria one must first identify and understand all important and relevant issues related to transport provision and operation as they currently exist. In this Chapter we provide an information baseline and commentary as a foundation for the development of the transport master plan.

It covers four key subjects:

- **A review of Bulgaria's economy and it's transport connectivity;**
- **The institutional and administrative structures** within which transport services are organised and delivered;
- **Financing** for transport infrastructure and operations; and
- **An inventory of the country's transport networks.**

2.2 Bulgaria - Economy and Transport

2.2.1 Demographics and Economy

Bulgaria has a population of 7.7 million (2007) and borders Greece, the Republic of Macedonia (FYROM), Romania, Serbia and Turkey. Its terrain consists mostly of mountains with lowlands in the north and southeast. The total area amounts to 111,000 sq kms.

Life expectancy is 72.6 years (2006) but fertility rates are comparatively low (1.38 births per woman). The overall population has been falling since at least 1999 and is predicted to continue falling mainly due to predicted low birth rates. Working age population (15-64) is also falling but at a slightly slower rate than overall population indicating that emigration of workers is not the main cause of population decline.

As is shown in **Table 2.1** Bulgaria's economy has experienced steady growth in the 6 years up to 2006 with the GDP/head rising at approximately 7.6% per annum (in real terms) and unemployment rates falling. The average annual household income in 2000 was BGN 3,530, but that has risen to BGN 7,130 for 2007. The Bulgarian Leva has been pegged with the Euro and 1 Leva trades at 0.51€. According to the World Bank, in 2006 Bulgaria attracted the highest levels of foreign direct investment, as a share of GDP, among Eastern European countries.

Table 2.1 - Bulgaria's Economy (1995 Constant Prices)

	2000	2001	2002	2003	2004	2005	2006
Population (millions)	8,190,876	8,149,468	7,891,095	7,845,841	7,801,273	7,761,049	7,718,750
Working Age (15-64)	5,569,796	5,557,938	5,381,727	5,366,556	5,367,276	5,362,885	5,341,375
GDP (millions of €)	9,612	10,453	10,976	11,705	12,436	13,193	14,024
GDP per capita (€)	1,173	1,283	1,391	1,492	1,594	1,700	1,817
GDP per capita growth		9.3%	8.4%	7.3%	6.9%	6.6%	6.9%
Population Growth		-0.5%	-3.2%	-0.6%	-0.6%	-0.5%	-0.5%
Working Age Population Growth		-0.2%	-3.2%	-0.3%	0.0%	-0.1%	-0.4%
Unemployment Rate	16.4%	19.5%	18.1%	13.7%	12.0%	10.1%	9.0%
Inflation	11.3%	7.6%	1.1%	5.6%	4.0%	7.4%	6.1%

Source: National Statistics Institute - Bulgaria

Bulgaria has reduced the rate of inflation since the deep economic crisis in 1996-1997, but latest figures showed an increase in the inflation-rate to 12.5% for 2007. The Bulgarian Economy Minister announced in May 2008 that the country's inflation rate had been declining each month since January 2008. In January 2008 inflation was 1.4% on a monthly basis, whereas in April it dropped down to 0.7%. The February and March values were 1.2% and 0.9% respectively.

Table 2.2 - Comparative Demographic and Economic Indicators (2007 prices)

2007 – preliminary	Bulgaria	Romania	Croatia	Turkey	Greece
Population, million	7.6	21.5	4.50	70.59	11.17
GDP per Capita, US$	5,619	7,697	11,373	9,304	29,680
Growth in real GDP	6.2%	6.0%	5.9%	4.5%	4.0%
Imports (billions of €)	24.3	68.80	25.53	160.70	55.61
Exports (billions of €)	18.10	43.10	12.60	113.19	81.01
Import : Export Ratio	1.3	1.6	2.0	1.4	0.7

Source: Emerging Europe Monitor, Volume 15, Issue 5, May 2008

The figures above are based on 2007 prices. Compared to the neighbouring countries of Romania and Turkey, Bulgaria has a smaller population and a much lower GDP per head, however, recent growth has been higher. The ratio of imports to exports is lower than seen in most of the other countries suggesting that there could be further growth in imports and potentially an increase in the trade deficit as wealth increases.

The major imports and exports in Bulgaria and the origins and destinations of the different goods are shown below in **Tables 2.3** and **2.4**. Combined trade is highest with Germany, Italy and Turkey.

Table 2.3 - Leading Markets & Suppliers

Major Destinations of Exports 2006	% of Total	Major Origins of Imports 2006	% of Total
Turkey	10.8	Germany	17.4
Italy	10.1	Russia	12.5
Germany	9.9	Italy	8.8
Greece	8.1	Turkey	6.1
Total	**38.9**	**Total**	**44.8**

Source: Economist Intelligence Unit, 2006

Table 2.4 - Major Imports & Exports

Major Exports 2006	% of Total	Major Imports 2006	% of Total
Other metals	14.5	Crude oil & natural gas	17.5
Clothing & footwear	13.7	Machinery & equipment	8.9
Iron & steel	7.5	Textiles	7.8
Chemicals, plastics & rubber	5.2	Chemicals, plastics & rubber	6.4
Total	**40.9**	**Total**	**40.6**

Source: Economist Intelligence Unit, 2006

It is clear from **Table 2.4** that the main exports are metals, and the main imports are oil and gas.

There is significant variation in the prosperity of different regions within Bulgaria. Comparisons based on GDP per head and rates of growth in GDP are shown in **Table 2.5**, this clearly demonstrates the dominance of Sofia and its surrounding region in the country's economy.

Table 2.5 - Economic detail by region in Bulgaria

	GDP - € mill (2005 Prices)	Population (2006, Thousand)	GDP per Head (2005 Prices)	GDP Growth 2001 - 2005	Population Growth 2001 - 2005	GDP per Head Growth 2001-05
North Western	€ 2,080	951	€ 2,152	17%	-6%	26%
North Central	€ 2,115	945	€ 2,217	30%	-4%	35%
North Eastern	€ 2,454	995	€ 1,962	39%	-2%	39%
Sofia & Region	€ 7,494	1,494	€ 5,038	63%	3%	59%
Blagoevgrad	€ 715	332	€ 2,138	49%	-2%	52%

	GDP - € mill (2005 Prices)	Population (2006, Thousand)	GDP per Head (2005 Prices)	GDP Growth 2001 - 2005	Population Growth 2001 - 2005	GDP per Head Growth 2001-05
Other S.W.	€ 644	292	€ 2,182	26%	-5%	33%
South Central	€ 3,372	1,558	€ 2,153	43%	-2%	47%
Stara Zagora	€ 1,103	359	€ 3,055	30%	-2%	34%
Other S.E.	€ 1,906	773	€ 2,271	47%	-3%	48%
Bulgaria	**€ 21,883**	**7,699**	**€ 2,827**	**43%**	**-2%**	**47%**

Source: Eurostat

Sofia is the capital city of Bulgaria and is the major centre of Bulgaria's economy. Despite the fact that the overall population of Bulgaria is declining rural migration has seen the Sofia area grow from 800,000 individuals to almost 1.5 million in less than 15 years.

2.2.2 *Bulgaria's Position within Europe*

Bulgaria holds a strategic geographical position within Europe. The favourable geographical location of the country can be seen clearly in the passage of five Pan European Corridors through the territory of the country: IV, VII, VIII, IX, and X, which are detailed below.

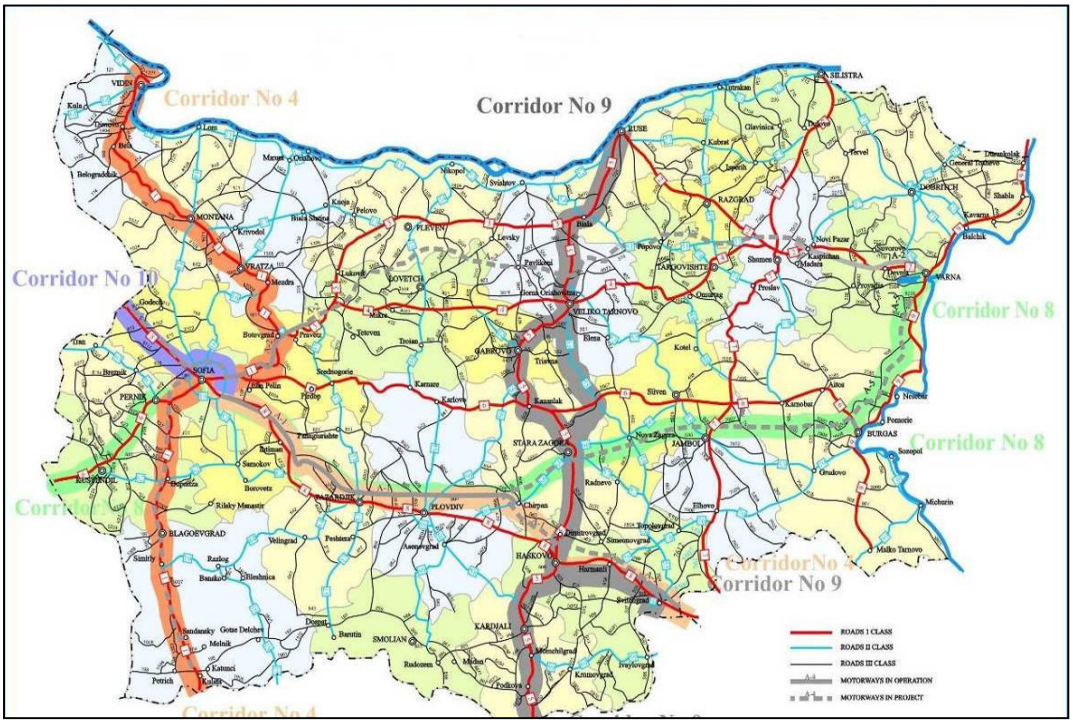
- **Corridor IV**: Germany - Turkey: Dresden / Nurnberg – Prague – Vienne / Bratislava – Budapest – Arad – Bucharest –Constanta / Craiova – Sofia – Thessaloniki / Plovdiv – Istanbul
- **Corridor VII**: The Danube River
- **Corridor VIII**: Italy – Bulgarian Coast: Bari / Brindisi – Durres / Vlora – Tirana – Kafasan – Skopje – Sofia – Plovdiv – Burgas / Varna
  - + the road link Ormenion – Svilengrad – Burgas, providing connection with Corridors IV, IX, and the Trans-European transport network
  - + Byala / Gorna Oryahovitsa – Pleven – Sofia, providing connection with Corridors IV and IX
  - + Kafasan – Kapstiche / Kristalopigi, providing connection with the Trans-European transport network
- **Corridor IX**: Finland – Russia – Romania – Bulgaria - Greece: Helsinki – Saint Petersburg – Moscow / Pskov – Kiev – Ljubasevka – Chisinau - Bucharest – Dimitrovgrad – Alexandruopolis
  - Branch A: Odessa - Ljubasevka / Razdelna
  - Branch B: Kiev – Minsk – Vilnius – Claipeda / Kaliningrad
- **Corridor X**: Austria - Greece: Saltsburg – Ljubljana – Zagreb – Belgrade – Nis – Skopje – Veles – Thessaloniki
  - Branch C: Nis - Sofia (Dimitrovgrad – Istanbul through Corridor IV)

There are 6 main external ground transportation connections with the neighbouring countries at Ruse (for Romania), Gyueshevo (for Macedonia), 2 crossings near Svilengrad (for Turkey and Greece), Kalotina (for Serbia) and Kulata (for Greece). A new Danube river bridge crossing at Vidin (for Romania) is due to be completed in 2011. There is no rail link to the Macedonian Republic.

The following Bulgarian railways are included in the European Agreement of Important International Combined Transport Lines and Related Installations (AGTC):

- Ruse-Gorna Oryahovitsa-Dubovo-Dimitrovgrad;
- Sofia-Mezdra- Gorna Oryahovitsa –Kaspitchan-Varna;
- Dragoman-Sofia-Plovdiv-Dimitrovgrad-Svilengrad;
- Plovdiv-Zimnitsa-Karnobat-Burgas;
- Vidin-Sofia – International Corridor IV and part of European priority project; and
- Sofia-Kulata (for Greece) – International Corridor IV and a European priority project.

Figure 2.1 – European Transport Corridors (TEN-T)



2.3 National Institutions with Responsibility for Transport

2.3.1 *Ministry Responsibilities*

The Council of Ministers of Bulgaria implements government policy in the transport sector through the Ministry of Transport, Information Technology and Communications. In Bulgaria the Minister of Transport manages and represents the Ministry of Transport. As head of the executive his responsibilities are:

- to conduct state transport policy;
- to prepare strategies for development and restructuring of transport;
- to distribute and control the consumption of funds allocated for transport from the state budget;
- to prepare projects for international contracts and agreements in the field of transport and ensure the implementation of international agreements and conventions, where Bulgaria is a contracting party;
- to organise and conduct transport during times of crisis;
- to represent Bulgaria in international transport organisations; and
- to control the activities of recipients of licenses, permissions, certificates, etc. issued by the Minister, or by representative persons authorised by the Minister.

The Minister of Regional Development and Public Works is responsible for forming state regional policy for the development of the republican roads. Together with the Minister of Transport they offer to the Council of Ministers a strategy for development of the road infrastructure in the country and a medium-term programme for its implementation.

2.3.2 *Road Transport*

The Executive Agency “Automobile Administration” carries out administrative services and controls domestic and international road transport of passengers and goods made by local and foreign carriers in Bulgaria.

The Agency is composed of 5 directorates:

- Road Transport;
- Administrative services;
- Financial and economic activities;
- Professional competence, psychological selection and drivers; and
- State automobile inspection.

There are 27 regional departments of the Agency across the country.

The Agency carries out administrative services and the control of domestic and international carriage of passengers and cargo undertaken by Bulgarian and foreign operators in the territory of Bulgaria.

The Agency is responsible for regulation of inter-city bus services and the private companies who operate the fleets of buses and services which cross the country linking towns and cities.

The Agency is also responsible for regulation of commercial goods vehicles. In Bulgaria all commercial vehicle operations are undertaken by private companies either as hire and reward or own account operators. Within Bulgaria the majority of fleets licensed over the last decade are small having less than 5 vehicles. The proportion of owner drivers is much smaller than in many other European countries at only 26% compared to 53% in the Czech Republic, 79% in Poland and 44% in the UK. The proportion of large fleets is also much smaller than for Western European countries and only a very small proportion have over 25 vehicles.

The Bulgarian Council of Ministers sets state policy for the planning, construction, management and maintenance of road infrastructure in the Republic of Bulgaria. This is done by adopting a strategy for development of road infrastructure and a medium-term operational programme for implementing this strategy. The Council is also responsible for providing any concessions on the republican roads and road facilities (bridges and tunnels), which are state property.

Roads in Bulgaria are managed by the following authorities:

- Republican roads are exclusive state property and are managed by the Agency for Roads Infrastructure (ARI);
- Municipal roads are public communal property and are managed by the Mayors of the municipalities; and
- Private roads are the property of particular legal entities or physical persons and are managed by their owners.

The ARI is the successor of the National Agency for Roads Infrastructure, which replaced the former National Roads Infrastructure Fund (NRIF) in 2008.

The Agency has two specialised units - Regional Departments and a Central Institute for Road Technologies, National and European Norms and Standards. The Agency is governed by a Management Board, which consists of a chairman and two members. Contracts with the Chairman and members of the board are concluded, amended and terminated by the Minister of Regional Development and Public Works. A subsidiary body of the Agency is the Technical and Economic Expert Council which observes, accepts and offers to the Management Board projects for construction, repair and maintenance of republican roads for approval and development.

2.3.3 *Rail Transport*

The "Railway Administration" Executive Agency coordinates and monitors activities in the field of rail transport through its headquarters in Sofia and regional units.

The “Railway Administration" Executive Agency functions as the regulatory authority for rail transport and is the national authority on safety in rail transport.

In 2002, after approval of a new Law for the railway transport, Bulgarian Railways were split into two organisations:

- Infrastructure - the State Enterprise National Railway Infrastructure Company (NRIC); and
- Operator - Bulgarian State Railways EAD

Railway infrastructure, its facilities and the land on which they are built are public state property. The NRIC manages all railway infrastructure and property. It controls the construction, repair, maintenance and operation of infrastructure. It is also responsible for traffic safety and the technical condition of rolling stock.

The NRIC organises, carries out and is responsible for execution of its obligation according to its long-term contract with Government. The company carries out the whole work based on investigations, forecasts and programs for development of the railway infrastructure according to this contract.

The NRIC is managed by the Minister of Transport, a Management Board and a General Director.

Bulgarian State Railways EAD (BDZ EAD) is a state company, which is divided into:

- BDZ - Freight services Ltd;
- BDZ - Passenger Carriage Ltd; and
- BDZ - Traction rolling stock (locomotives) Ltd.

In addition there are currently (December 2008) five independent rail freight operators in Bulgaria:

- BDZ Tovarni Prevosi;
- Bulmarket OOD;
- Bulgarian Railway Company AD-BJK;
- Gastreid AD; and
- Unitranscom AD.

A specialised unit to investigate accidents and incidents in rail transport was set up in May 2006 following an amendment to the Law on Railway Transport (LRT). Operating within the Ministry of Transport, Information Technology and Communications the unit investigates:

- serious rail accidents;
- other accidents and incidents based on criteria established by order of Minister of Transport; and
- accidents and incidents, referred by the Minister of Transport from the Executive Agency Railway Administration.

2.3.4 *Air Transport*

Civil Aviation in Bulgaria is controlled by the Directorate General "Civil Aviation Administration" (CAA).

The CAA is responsible to the Minister of Transport for all administrative and regulatory functions applying to aviation. Overseen by a Director General and managed by the Secretary General the DG CAA is organised into four directorates:

- Financial, Administrative, Legal and Information;
- Aviation Safety;
- Airports, Aviation Security and Air Navigation Services; and
- European Integration, International Regulations and Economic Regulations.

In addition to the four directorates the CAA also oversees five regional centres across the country.

There are four fully operational international airports in Bulgaria.

"Sofia Airport" EAD is a single company with state property. Owner of the shares is the Bulgarian State, whose rights are exercised by the Minister of Transport.

The assets of Varna and Burgas airports are also state-owned (Ministry of Transport, Information Technology and Communications) via the legal entities known as Varna Airport EOOD and Burgas Airport EOOD. However, these airports are the subject of a concession arrangement whereby FRAPORT Twin Star Airport Management AD has agreed to operate the airports.

Airport Plovdiv EAD is a sole trading company with state property. Owner of the shares is the Bulgarian State, whose rights are exercised by the Minister of Transport. Airport Plovdiv JSC is a joint stock company which was formed from Plovdiv Airport Ltd and Investment Fund Trakiya AD.

The Air Traffic Services Authority (ATSA) is a State-owned enterprise (Ministry of Transport, Information Technology and Communications) which provides air navigation services in the controlled civil airspace of Bulgaria through area control centres at Sofia and Varna and approach/tower services at Burgas, Plovdiv and Gorna Oryahovitsa airports. As part of its function ATSA provides, maintains and operates the relevant air navigation and lighting systems and equipment at airports. As a result ATSA owns various navigation, lighting, electrical and meteorological assets at the airports.

The primary Bulgarian registered air carriers are all private companies and are as follows:

- Hemus Air (15 short-haul aircraft).
- Bulgaria Air (9 short-haul aircraft).
- Air Via (4 short-haul aircraft).
- Bulgarian Air Charter (9 short-haul aircraft).
- BH Air (4 short haul aircraft plus one business jet).
- Wizz Air Bulgaria (2 short-haul aircraft).

2.3.5 *Water Transport*

The administration of activities relating to ports, harbours, navigation and shipping is controlled by the Executive Agency "Maritime Administration" (EAMA). The obligations of the agency include port registrations, certifying port exploitation abilities and collecting statistical data according to Regulation 919. The agency has headquarters in Sofia and regional directorates as follows: Directorate "Maritime Administration" and Directorate "Port Administration" in Varna; Directorates "Maritime Administration" and "Port Administration" in Burgas; Directorates "Maritime Administration" and "Port Administration" in Ruse; and Directorates "Maritime Administration" and "Port Administration" in Lom. EAMA was formed by the incorporation of two agencies - Maritime Administration and Port Administration.

The Executive Agency "Maritime Administration" is responsible to the Minister of Transport, Information Technology and Communications.

The Executive Agency for Exploration and Maintenance of the Danube River is based in the town of Ruse and carries out activities in accordance with national and international law, regarding the navigational conditions on the Bulgarian inland waterways.

The Bulgarian Ports Infrastructure Company is a state company of the Ministry of Transport, Information Technology and Communications, which manages the infrastructure and other durable assets of the public transport ports of national importance.

Public transport ports of national importance are:

- Port of Varna (Varna East, Varna West, Ezerovo Power, Oil, Lesport, ferry complex - Varna and Balchik)
- Port of Burgas (Burgas East, Burgas West, Rosenets, Nessebar)
- Port of Ruse (Ruse East, Ruse Centre, Ruse West, Silistra, Tutrakan, Svishtov and Somovit)
- Port of Lom (Lom and Oryahovo)
- Port of Vidin (Vidin Centre, Vidin South, Vidin North and Vidin ferry complex – Vidin-Calafat)

In addition to ports of national importance there are many smaller ports of regional importance.

The land and port infrastructure at ports of national importance are public state property, except for areas for storage of goods that can be owned by private companies and individuals.

The land and port infrastructure at ports of regional significance may be the property of the state, municipalities or private companies and individuals.

Shipping services in Bulgaria are provided by the Bulgarian Maritime fleet, state-owned fleets of other countries and private shipping companies. Activities of all vessels are regulated by the Maritime Administration Agency.

Port operations at the principal ports of Burgas, Varna, Lom and Ruse are primarily undertaken by the state-owned Port Operating Companies. There has been a trend towards terminal operation under private concession, but progress has been relatively slow partly due to the complex legal procedures required.

2.4 Financing

2.4.1 *National Budget*

The national state budget for spending on transport in 2008 was BGN 77.7million. This accounted for 1.2% of the total state budget. The transport budget for 2009 has been increased by 5% to a total of BGN 81.5 million. The additional resources for each mode of transport outside the budget of the Ministry of Transport, Information Technology and Communications are available for each year in the Law for the budget or long-term plans and programs.

The transport budget, excluding the budget for the ARI which is held separately, is sub-divided into different programmes as tabulated below.

Table 2.6 - 2008 Transport Budget

Prog. №	Name of the program	Amount
		BGN
	Policy for modernisation of transport infrastructure	**28,219,700**
1	Development of the rail infrastructure and combined transport	5,855,600
2	Development of the infrastructure of the water transport	3,346,000

Prog. №	Name of the program	Amount
3	Development of the infrastructure of the air transport	19,018,100
4	Planning and control of the road infrastructure	**0**
	Policy for improving the organization and management of transport	**2,805,400**
5	Regulation of the trade access and profession	847,000
6	Common access transport	0
7	Survey and maintenance of the water routes	1,958,400
	Safety and security policy and environmental sustainability in transport	**26,631,900**
8	Control and adoption of standards in the road transport	7,896,600
9	Control and adoption of standards in the rail transport	700,200
10	Control and adoption of standards in the air transport	5,602,000
11	Control and adoption of standards in the water transport	4,763,700
12	Crisis management, risk prevention, search and rescue, investigation of accidents	1,961,000
13	Medical and psychological expertise	5,708,400
14	**Aviation**	**6,971,200**
15	**Administration**	**13,047,500**
	Total:	**77,675,700**

Source: Ministry of Transport, Information Technology and Communications - Bulgaria

International funding includes various programmes for which Bulgaria as a pre-accession state and now as a full member is eligible. In relation to transport these include:

- Pre-Accession Funds (now superseded but still working through**)**
  - PHARE - European Union's financial and technical assistance to help countries of Central Europe prepare for accession to the EU; and
  - ISPA - infrastructural projects in the environmental and transport fields.
- Cohesion Funds – grants to help EU member states to resolve structural economic and social problems and disparities and overcome peripherality within the Union. The Cohesion Fund finances up to 85% of eligible expenditure of major projects involving the environment and transport infrastructure.
- European Regional Development Fund (ERDF) is used to promote economic and social cohesion and overcome economic disadvantage within the European Union through the reduction of imbalances between regions or social groups.

The programming and preparation for the absorption of the Structural and Cohesion Funds since 2007 is done by development of multi-annual strategic documents – Operational Programmes. Two Operational Programmes provide the opportunity for funding of transport initiatives in Bulgaria in the period 2007 to 2013:

- Sectoral Operational Programme for Transport (SOPT) – in particular:
  - Priority Axis I - Development of railway infrastructure along the major national and Pan-European transport axes
  - Priority Axis II – Development of the Road Infrastructure Across the Trans-European and the Main National Transport Axes
  - Priority Axis III - Improvement of intermodality for passengers and freight;
  - Priority Axis IV - Improvement of the maritime and inland-waterway navigation; and
  - Priority Axis V – Technical assistance
- Sectoral Operational Programme for Regional Development – primarily for the rehabilitation of existing infrastructure.

2.4.2 *Road Infrastructure*

Construction, renovation, repair and maintenance of the republican and municipal roads are financed with funds from:

- the state budget;
- municipal budgets;
- grant funds available; or
- loans from international financial institutions.

The ARI is responsible for financing activities related to construction, repair and maintenance of republican roads outside the towns and at road junctions. It is also responsible for costs associated with the compulsory purchase (expropriation) of land and with changes to the status of agricultural land and forests.

The Council of Ministers sets the limit for capital expenditure in the budget of ARI.

ARI and the municipalities jointly finance projects for construction and repair of sections of the republican roads within urban areas in respective ratios.

Municipalities finance the activities related to construction, repair and maintenance of municipal roads, road junctions and crossroads, as well as parts of them that are part of the municipality road network with funds provided by the target transfers from the central budget and from budgets of extra funds and accounts of municipalities provided with free resources and loans.

2.4.3 *Rail*

Construction, maintenance, development and operation of the railway infrastructure, is funded by the State with a contribution from user charges generated by railway operations. These contributions include infrastructure charges, income from other commercial activities of the infrastructure manager and through loans.

The amount of funding is set within a long-term contract between the state, represented by the Ministers of Finance and Transport, and the NRIC.

To support investment activities the NRIC makes long-term, medium-term and short-term programmes to maintain and develop infrastructure. Each year, the NRIC presents an annual programme on priority projects and applies to the Ministry of Transport, Information Technology and Communications and the Ministry of Finance to finance them. In recent years, if the budget has been overspent, the Council of Ministers has provided additional funds for investment projects at the end of the year.

Funding is also available from the SOPT, specifically:

- Priority Axis I - work in construction and development of key rail infrastructure links with national, trans-border and European importance and the improvement of the interoperability of the main rail arteries. The main activities are construction, rehabilitation, upgrading and electrification of railway lines and stations on the Trans-European transport axes.
- Priority Axis III - main activities are expanding the network of terminals for combined intermodal transport and the development of urban underground railways that connect key transport centres of national importance (central railway stations, airports, etc.)

The state rail company, BDZ also receives funding for socially necessary passenger services based on its obligation for public services as the passenger operator.

2.4.4 *Air Transport*

The financing of activities to ensure the safety of flight and maintenance and development of state-owned civil airports for public use is through the budget of the Ministry of Transport, Information Technology and Communications.

Where an airport is operated through a concession the source of funding of any infrastructure changes will depend on the concession contract in accordance with the decision of the Council of Ministers on the granting of the concession.

The SOPT does not recognise aviation as one of the priority axes for funding.

Income to support state funding or funding from the concessionaire comes from a number of commercial sources, notably:

- Landing and other direct aviation charges;
- Income from commercial activities at the airports; and
- Interest on deposits of its own funds and late payments.

2.4.5 *Water Transport*

The financing of activities to ensure the safety of shipping and the maintenance and development of ports is through the budget of the Ministry of Transport, Information Technology and Communications through funds from the state budget or with funds from loans guaranteed by the state.

The ports of national importance – Varna and Burgas on the Black Sea and Ruse, Lom and Vidin on the River Danube, are currently operated by state port operators. Terminals within these ports are being considered for concession in the future.

As with the airport concessions at Varna and Burgas funding of any infrastructure changes will depend on the concession contract in accordance with the decision of the Council of Ministers on the granting of the concession.

Water transport is included as one of the five priority axes within the SOPT. Priority Axis IV - Improvement of the maritime and inland-waterway navigation - targets the improvement of navigation along inland water-ways, notably the river Danube (TEN-T and EU Priority Project 18), removing bottlenecks in the two most critical sections in the joint Bulgarian-Romanian section of the Danube River (between km 530 and 520 – Batin and the section between km 576 and km 560 – Belene). Also included is the establishment of a River Information System.

Completion of the Vessel Traffic Management Information System is also proposed.

Financing for any port infrastructure improvements will come from state guaranteed loans to the Bulgarian Ports Infrastructure Company (BPICo).

2.5 Transport Networks

2.5.1 Road Transport

2.5.1.1 Highway Network

The road network in Bulgaria consists of Republican and Local roads.

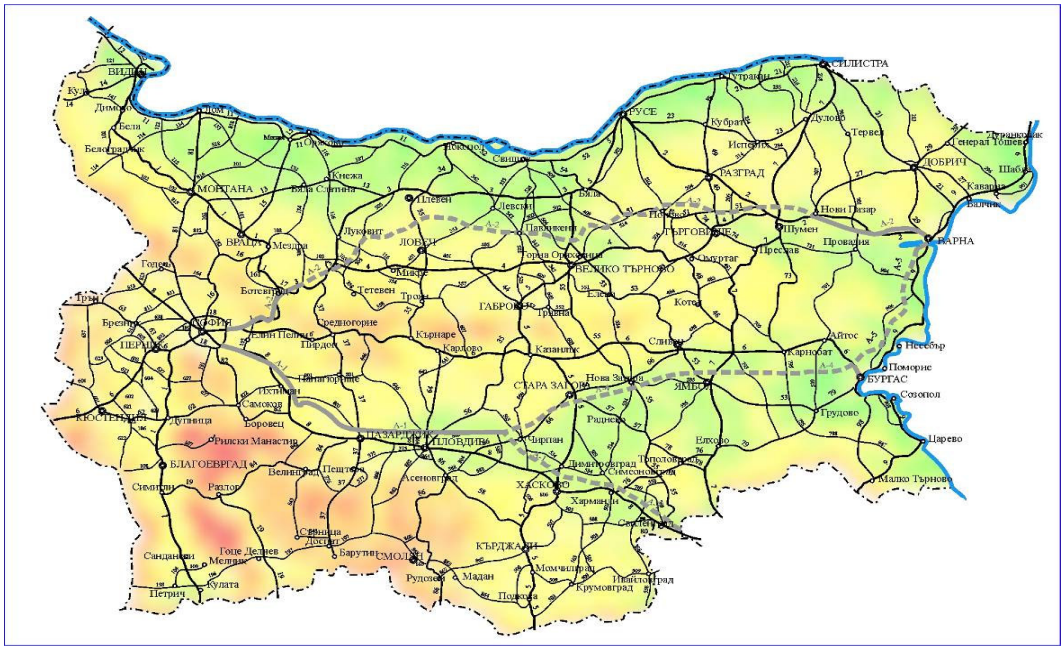
Republican roads consist of motorways and Class I, II and III roads, which provide transport links of national importance and form the state road network. Particular Republican roads are included in the Trans-European road network.

Local roads comprise municipality roads and private roads.

This classification of roads in Bulgaria was approved in 1999. Previously there had been a Class IV category but all of these were re-classified to Class III.

The network of Republican roads is shown in **Figure 2.2.**

Figure 2.2 - Republican Roads Network in Bulgaria



The length of the entire road network in Bulgaria exceeds 40,800 km including 19,373 km of Republican roads and 21,432 km of local municipality roads.

The strategic motorway network in Bulgaria is planned to comprise of six principal routes:

- **A1 Motorway "Trakia"** is part of the Trans-European Transport Corridors No. IV, VIII and X and is situated on the route Sofia – Burgas running via Plovdiv, Stara Zagora, and Karnobat. The motorway is not complete; there is a gap between Stara Zagora and Karnobat. Of a total completed length of 446 km, 245 km are in use. The A1 is a vital connection between the Black Sea Ports and the capital city and as an international transit route for waterborne trade via the Black Sea.
- **A2 Motorway "Hemus".** When complete will run from Sofia to Varna via Veliko Tarnovo and Shumen. The planned motorway length is 456 km. Two sections are currently in use; Sofia to Yablanitsa and Shumen to Varna. These sections have a total length of 160 km, which is 35% of the planned length.
- **A3 Motorway "Maritsa"** is part of the Trans-European Transport (TEN-T) Corridors No. IV and IX linking the A1 close to Chirpan with the Turkish and Greek borders close to Svilengrad. It has a planned length of 117 km but only the section between Lyubimets and Svilengrad (40 km) is currently complete.
- **A4 Motorway "Black Sea"** is part of the Trans-European Transport Corridor No. VIII running from Burgas to Varna along the Black Sea Coast, linking the Hemus and Trakia motorways. It has a planned length of 102 km but only 8 km are currently in use.
- **A5 Motorway "Lyulin"** will be part of the Trans-European Transport Corridors No. IV and VIII and will run from Pernik at the northern end of the A6 to connect with the western side of the Sofia Ring Road. Currently under construction it has a planned length of 19 km.
- **A6 Motorway "Struma"** is part of the Trans-European Transport Corridor No. IV running from Sofia to the Greek border at Kulata. When complete it will be 156 km long. Only the northernmost section between Daskalovo and Dolna with a total length of 19 km is currently in use.

Bulgaria is bordered in the west by Serbia and Macedonia, in the south by Greece and Turkey, in the east by the Black Sea and in the north by Romania. As a result Bulgaria is a transit country for many trans-European connections.

The motorway coverage and the coverage of roads with four or three lanes in Bulgaria are very irregular. The majority of Class I, II and III road are single carriageway with one lane in each direction. This severely limits the opportunities for overtaking particularly on the many narrow, hilly and bendy sections of road.

The east-west directions are generally better developed than those crossing the country from north to south. The services in the periphery are unsatisfactory, particularly on the southern border, along the Danube River and those situated between the Trans-European Transport Corridors IV, VIII and IX.

2.5.1.2 Highway Asset Condition

The technical condition of the republican roads should be generally considered as unsatisfactory, particularly for roads of a lower class. The condition of the network in 2007 is shown in **Table 2.7** below.

Table 2.7 - Condition of Bulgaria's National Road Network (2007)

Road Class	Length (km)	Good (%)	Fair (%)	Poor (%)
Motorways	394	82.7	13.6	3.7
Class I	2,969	56.7	20.3	23
Class II	3,989	42.4	28.6	29
Class III	11,475	29.1	32.5	38.4
Total (*Average*)	18,827	37.4	29.4	33.2
Note: Around 18,000 km of local roads are not included.				

Source: Analysis on the state and prospects for development of road infrastructure. Ministry of Transport

There are around 3,400 bridges which span 5 metres or more and over 1,300 bridges with a span over 20 metres. Surveys conducted between 2002 and 2005 identified that 36% of the structures with over 20 metres span distance require maintenance for prevention of further deterioration and 15% need immediate repair. There are 31 major tunnels on the Republican Road Network with an average length of approximately 340 m.

The condition of the Republican Road Network had experienced deterioration in its condition as the level of funding for maintenance fell during the 1990s. In recent years there has been an increase in

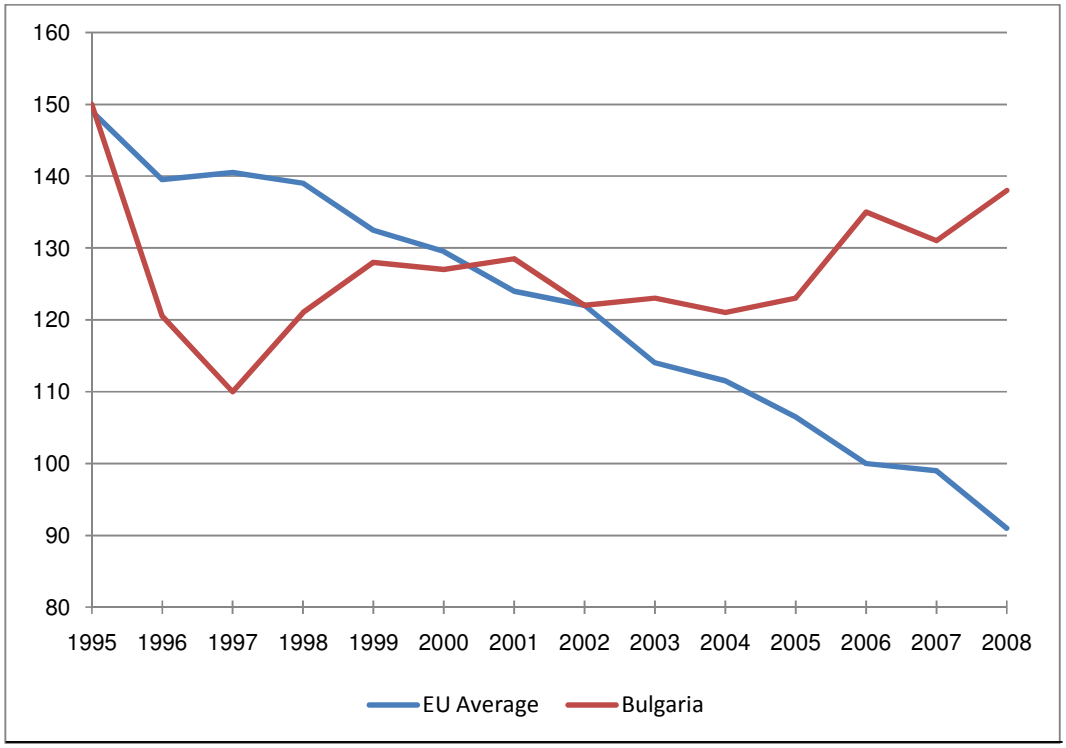
maintenance spending but it is still far behind the average spent in EU countries measured as a proportion of GDP.

2.5.1.3 Road Safety

Bulgaria has a poor road safety record both in absolute terms and in comparison with other European countries. **Figure 2.3** shows that in 1995 the fatality rate in Bulgaria at 150 persons killed per million population is almost identical to the European average of 149. This in itself is indicative of a serious road safety problem in Bulgaria because car ownership and usage levels in the country were well below European averages.

The comparison becomes worse when data is examined through to 2008. The numbers of people killed in road traffic accidents per million population in Europe reduces from 149 to 91, indicative of a radical improvement in safety. In Bulgaria however the reduction is much smaller, from 150 to 138, with no reduction at all in the nine years up to 2008.

Figure 2.3 - Number of killed people in road accidents per 1 Million inhabitants



Source: European Commission Transport Website

2.5.2 Rail Transport

2.5.2.1 System Overview

The railway in Bulgaria is split between operations and infrastructure management in common with other European Union member states. This change took place in January 2002 and established the National Railway Infrastructure Company (NRIC) whilst the incumbent state railway, BDZ EAD, became responsible solely for train operations. The Bulgarian Railway network is overseen by the Ministry of Transport, Information Technology and Communications and the Railway Executive Agency who carry out their functions within European railway legislation.

The dominant train operator is BDZ, it is the sole passenger operator and its freight division is also the majority freight operator. However, there are four other freight operating companies which provide competition for BDZ EAD and an open-access market is emerging.

The Bulgarian rail network consists of 4,316 km of lines, of which 94.3% are standard gauge, with the remainder being narrow gauge (760 mm). Only 22% of the whole system is double track, but 70% is electrified which is above the European average. There are approximately 400 stations and 300 halts.

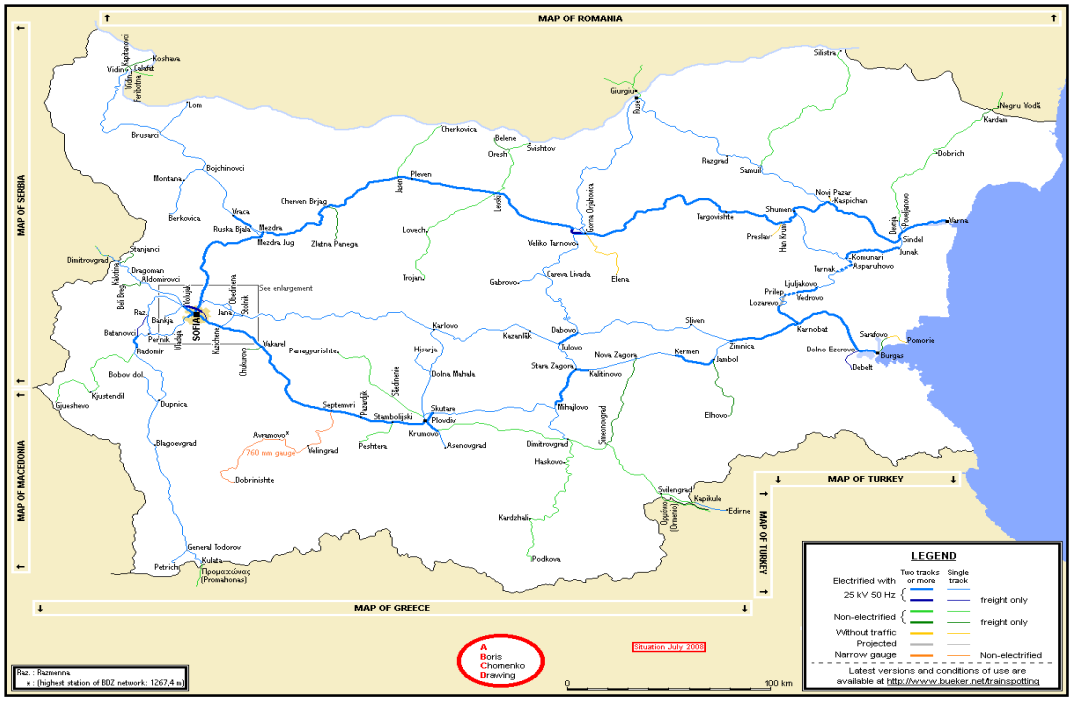
The Bulgarian rail network gives good penetration to almost all significant areas of the country, which provides good accessibility to potential customers. It also means that all principal population centres are connected to the capital, Sofia, within 12 hours' rail travel time (see **Figure 2.4**).

For geographical and historical reasons the main railway lines of the country are oriented in an East-West direction. This transport axis is particularly important to support trade through the Black Sea Ports, enabling import, export and transit traffic to pass swiftly and efficiently. Maintaining these connections at a high standard will be vital to maintain Bulgaria's competitive trade position against neighbouring countries, particularly Greece and Romania.

BDZ EAD runs a total of 560 passenger services each day. The most heavily used routes are the lines around Sofia, Varna and Plovdiv.

Bulgaria is bordered by five countries, with further destinations accessible from the ports at Varna and Burgas on the Black Sea. Bulgaria's location in the south-east Balkans occupies a strategic position in the "European" rail network. However, overall international rail capacity is dictated by the number of crossing points, of which there are only one or two into each country. All these lines are single track, the majority of which lie on non-electrified routes. These factors therefore serve to constrain the capability of Bulgaria's international network.

Figure 2.4 - Bulgarian Rail Network 2008



Source: http://www.bueker.net/trainspotting/map.php?file=maps/bulgaria/bulgaria.gif

Presently some 42% of Bulgaria's railway network lies on TEN-T designated corridors.

2.5.2.2 Rail asset condition

The major infrastructure assets of Bulgarian Railways include:

- 3,102 km of single track;
- 1,938 km of double track;
- 1,960 km of track at stations;
- 852 level crossings;
- 147 tunnels;
- 1,018 bridges;
- 8,000+ switches and crossings.

All sectors of the Bulgarian railway industry acknowledge that the railway infrastructure has suffered from a serious shortfall in maintenance and asset replacement since 1989. Such underinvestment in maintenance

reduces asset life and precipitates early and unplanned replacement. The past ten years has seen the introduction of nationwide temporary speed restrictions which significantly damage the competitive position of the railway network.

Existing levels of train performance reflect poor levels of infrastructure reliability. In the first 6 months of 2008, over 25% of suburban trains suffered a recordable delay of over 30 minutes to one hour late. 60% of international trains were delayed along with 15% of fast trains.

The principal reasons for delay include:

- The imposition of temporary speed restrictions which in turn reflects the underlying condition of track, switches, crossings and infrastructure;
- Catenary defects; and
- Signal and control system failures.

Up to 75% of the network is subject to speed restrictions or other operational limitations (including weight). Not only does this impact on current service provision but it seriously affects the ability of new investment schemes to deliver their planned benefits.

2.5.2.3 Rail vehicle fleet – freight (size, capability, age, condition)

A fundamental characteristic of the rail freight fleet structure is that only half of the total locomotives are operational, with 40% for possible repair and the remainder for scrap. Only 33% of the wagon fleet is available for use.

The age profile of BDZ's rolling stock gives significant cause for concern. Virtually all the fleet is more than 10 years old, with 59% older than 20 years. The average age of BDZ's wagons and locomotives is over 25 years. Only 50 wagons and 7 locomotives have been refurbished, financed by the World Bank and the European Development Bank.

2.5.3 Sea Ports

Bulgaria has two principal sea port complexes, Burgas and Varna, both on the Black Sea.

Current Sea ports capacity is estimated by the Ministry of Transport, Information Technology and Communications to be 30-35mtpa.

The combined Black Sea ports throughput for 2006 was 27.5mt, comprising 17.6mt through Burgas (together with the turnover of Oil Port Rosenets) and 9.9mt through Varna. For 2007 the total throughput was lower at approximately 26mt. The decline after 2007 is partly due to the global economic crisis.

The ports are considered by the Ministry to have sufficient capacity for the current level of throughput of general cargo, solid and liquid bulk cargo, containers, heavy parcels and ro/ro.

The Bulgarian Black Sea ports are affected by the physical draft limitations of the Bosporus Straits linking the Black Sea with the Eastern Mediterranean. There is currently an air draft limitation of 58 m under the bridges linking the European and Anatolian sides of Istanbul, and a ship length restriction for night transits of 200 m.

The current statistics confirm that the operation of the ports is comparable and competitive with the ports of the other Black Sea countries in terms of costs.

This competitiveness is however under threat in two ways. Firstly, if the ports do not ensure that they comply with all applicable standards and procedures backed by appropriate certification and quality control for operations, safety and security they will lose trade to other countries.

Secondly the ports cannot be considered in isolation. The ports are a gateway to and from Bulgaria and to trade that is transiting through Bulgaria. The success of the ports and their ability to provide for speedy and efficient movement of goods and materials relies very heavily on the quality of the landside transport connections. High standard East-West transport network connections from the ports of Burgas and Varna by road and rail are therefore vitally important to their success in attracting trade.

2.5.4 Inland Water Transport - The River Danube

The Danube is navigable by ocean ships from the Black Sea to Brăila in Romania and by river ships to Kelheim in Germany; smaller craft can navigate further upstream to Ulm, in Germany. About 60 of its tributaries are also navigable.

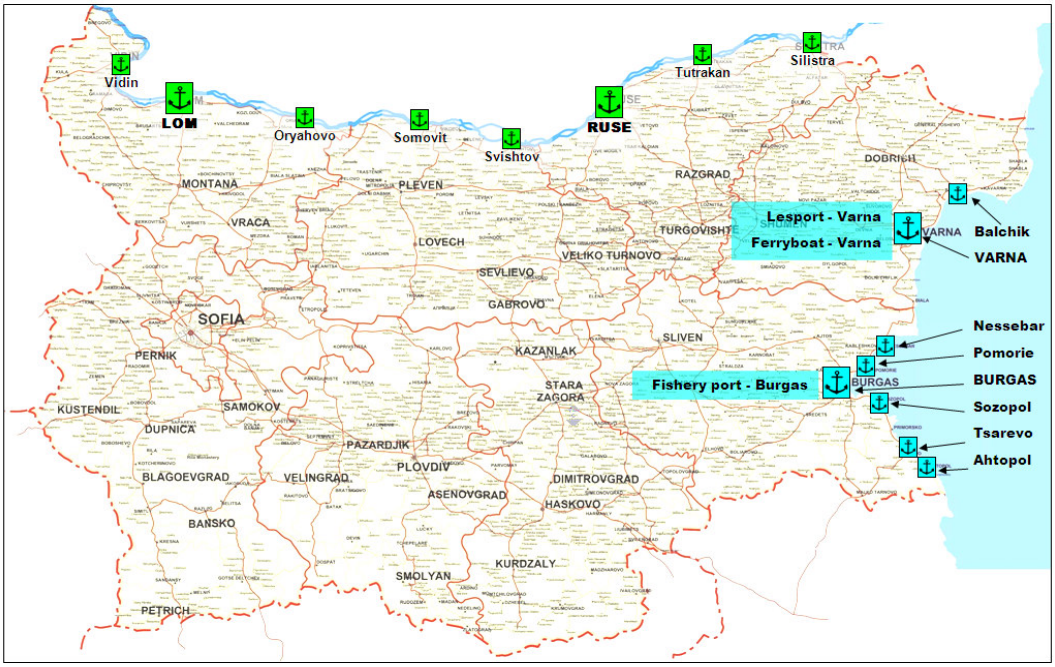
Since the completion of the German Rhine–Main–Danube Canal in 1992, the river has been part of a trans-European waterway from Rotterdam on the North Sea to Sulina on the Black Sea (3,500 km). In

1994 the Danube was declared one of the Pan-European transport corridor routes in Central and Eastern Europe that required major investment over the following ten to fifteen years. The amount of goods transported on the Danube increased to about 100 million tonnes in 1987. In 1999, transport on the river was made difficult by the NATO bombing of three bridges in Serbia. The clearance of the debris was finished in 2002. A temporary pontoon bridge that hampered navigation was finally removed in 2005.

Current river ports capacity is estimated by the Ministry of Transport, Information Technology and Communications to be 10mtpa.

The location of the principal ports on the Black Sea and River Danube are shown on **Figure 2.5**.

Figure 2.5 – Location of Bulgarian Ports



2.5.5 *Airports*

2.5.5.1 Locations

There are currently four functioning and fully operating international civil airports in Bulgaria:

- Sofia;
- Varna;
- Burgas; and
- Plovdiv.

In addition Gorna Oryahovitsa is fully functioning but has no current scheduled flights and there are three non-functioning airports at Ruse, Turgovishte and Stara Zagora, as well as a number of certified airfields.

The locations of these airports are shown at **Figure 2.6**.

2.5.5.2 Sofia Airport

Sofia airport is 100% State owned by the Ministry of Transport, Information Technology and Communications.

The original Terminal 1 has been extended and improved many times but underwent a fundamental refurbishment in 2000. Terminal 1 is used primarily by low cost airlines whilst Terminal 2, opened in 2006, handles traditional scheduled airlines.

The total assessed annual capacity of both terminals combined at Sofia airport is 4.4 million passengers (2.6mppa at Terminal 2 and 1.8mppa at Terminal 1).

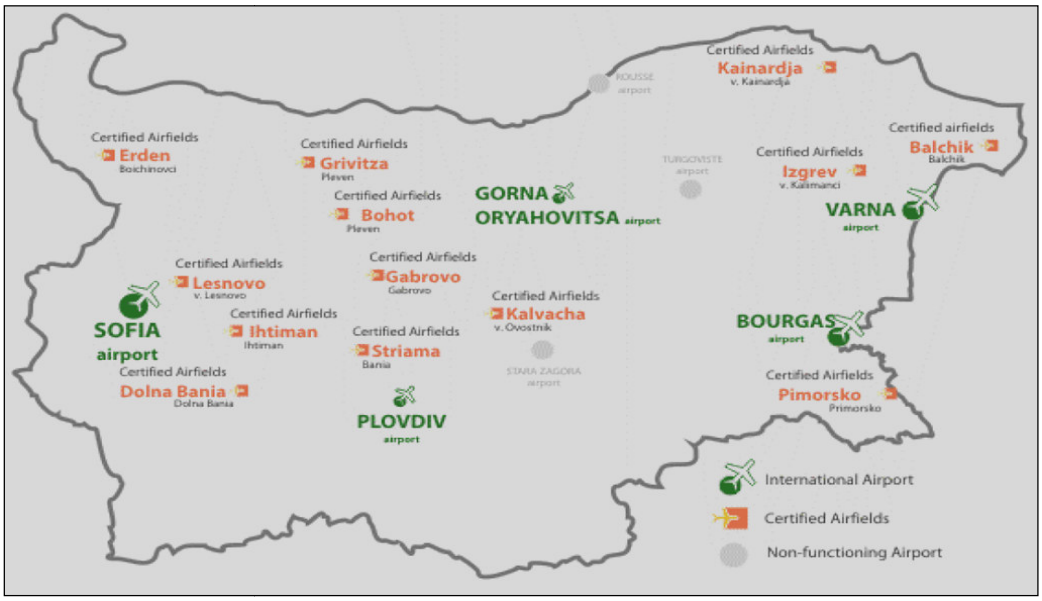
In August 2006 a new 3,600m long and 45m wide runway (International Civil Aviation Organisation [ICAO] aerodrome reference code 4E) came into operation at Sofia airport together with new rapid exit taxiways providing a high level of capacity and capability for the largest passenger aircraft types – code 4E. The

runway currently has spare capacity in the short-medium term with a current maximum hourly movement rate (combined arrivals and departures) of 14 aircraft and an assessed capacity of 25 runway movements per hour.

There are two cargo terminals at Sofia Airport. The first is operated by the Sofia Airport Company and the second is operated by MM Aviation Services. The majority of the cargo handled at Sofia Airport (approximately 65%) is handled by the Sofia Airport Company.

The current cargo handling facilities at Sofia Airport have an approximate capacity of 20,000 tonnes per annum and consist of warehousing at 14,600m² including a bonded area, a transit zone, mechanical handling equipment, refrigerated storage areas, fresh meat inspection facilities, X-Ray screening equipment, secure areas for valuables, dangerous and radioactive goods handling and an express/courier centre.

Figure 2.6 - Location of Bulgarian Airports



Source: Bulgarian CAA

2.5.5.3 Varna and Burgas Airports

Both Varna and Burgas airports are currently concessioned to FRAPORT Twin Star Airport Management AD but remain in State ownership (Ministry of Transport, Information Technology and Communications).

The concession to operate and develop Varna and Burgas airports began in 2006 and runs for 35 years to 2041. As part of the concession agreement the concessionaire is obliged to invest a total of over €400M in both airports to improve asset condition, passenger service levels and airport capacity.

Varna airport currently has two passenger terminals. Terminal 1 was built in 1972 and was subsequently refurbished and expanded a number of times. The main fabric of the terminal is in reasonably good condition and appears to be well maintained and cleaned by the concessionaire.

During the busy summer months there is insufficient capacity within the airport terminal leading to queues, congestion and poor passenger service levels.

The runway at Varna Airport is ICAO 4E with a length of 2,500m and a width of 45m meaning that it can accommodate large civil aircraft including the Boeing 747. The runway pavement is in fair to good condition and the runway is equipped with navigational aids for instrument landing giving the runway an effective usability of 100%.

Cargo volumes at Varna airport are currently very low and currently there is no dedicated cargo handling facility.

Burgas airport has two passenger terminals immediately adjacent to each other; one dedicated for departures and one dedicated for arrivals. The departures building was built approximately 40 years ago and since then has been remodelled and refurbished a number of times; the most recent and most extensive refurbishment taking place in 2000. The current departures building acted as the original

terminal building housing both arriving and departing passenger flows. Arriving passengers were transferred to the dedicated arrivals building when this was built in 1992.

Both the departures and the arrivals buildings are severely capacity constrained. The design capacity of the arrivals building is 800 passengers per hour, however, flows during the summer peak can exceed 1,500 passengers per hour. The design capacity of the departures building is 700 passengers per hour but flows during the summer peak can exceed 1,200 passengers per hour.

Burgas airport has a single ICAO Code 4E concrete runway 3,200m long and 45m wide allowing it to handle large aircraft including the Boeing 747. The runway is in good condition and is equipped with the navigational aids for instrument landing giving the runway an effective usability of 100%.

Cargo facilities at Burgas airport are currently outdated and cargo does not play a major role at the airport.

2.5.5.4 Plovdiv Airport

Plovdiv airport is situated 10km from Plovdiv city (population 700,000) and approximately 130km from Sofia city (population 1.2 million).

The airport currently specialises in serving charter flights principally from the UK, Ireland, Denmark, and Russia for the Bulgarian mountain ski resorts (Pamporovo and Borovets) during the winter season. Plovdiv airport also acts as a diversion airport for Sofia when Sofia airport is closed due to bad weather/low visibility conditions.

A new passenger terminal was opened in 2009 and provides modern facilities with sufficient capacity to accommodate currently anticipated growth in demand.

Plovdiv Airport has a Category 1 instrument landing system for a 2,500m long and 45m wide runway. The ICAO aerodrome reference code is 4D enabling it to handle large aircraft. The runway has a parallel taxiway 22.5m wide running along its length. This means that in terms of runway capacity Plovdiv Airport has sufficient capacity for the long term.

2.5.6 Intermodal Operations and Facilities

2.5.6.1 Intermodal Passenger Transport

Intermodal passenger transport involves more than one mode of transport of passengers for a single journey. Some modes of transportation have always been intermodal; for example, most major airports have extensive facilities for car parking and have good public transport connections to the cities nearby. Another example is an urban bus system that connects with train and subway stations. A major goal of modern intermodal passenger transport is to reduce dependence on the car as the major mode of ground transportation and increase use of public transport.

In Bulgaria intermodal passenger facilities are not generally well developed although there are a few notable exceptions most importantly in Sofia. The Central Railway and Coach Station are located next to each other and there are direct walking links between the rail station and the tram stops. The international airports in Sofia, Burgas and Plovdiv however, suffer because there are no rail or subway connections giving arriving and departing passengers a limited choice of public transport connections.

2.5.6.2 Intermodal Freight Transport

Intermodal freight transport involves the transportation of freight in a container or vehicle, using multiple modes (rail, ship/boat, and truck), without any handling of the freight itself when changing modes. The method reduces cargo handling, resulting in faster and potentially more cost effective movement of goods and materials.

Major Intermodal facilities for freight in Bulgaria are currently primarily associated with the transfer of containers between ships and trains in the ports of Varna and Burgas. These facilities are relatively old and of limited capacity and capability. Ports in Ruse and Lom have potential for treatment of containers, but they do not have the required facilities and organisation for transfers. Intermodal facilities also exist for transfer between rail and road at a number of relatively small rail freight stations around the country, again however they are not currently well used and much of the equipment is inefficient and out of date.

As a result there are inefficiencies in the movement of freight in Bulgaria, particularly in comparison with other European countries where facilities are more common and more highly developed. In addition the lack of intermodal terminals reduces the opportunity for transfer to the more sustainable forms of transport, notably rail and water.

3 Transport Models

3 Transport Models

3.1 Introduction

At its simplest level transport is the movement of people and materials and is dependent on both transport supply, that is the transport networks and services; and transport demand that is the numbers of people and the volumes of materials to be transported and their origins and destinations. It is the understanding of interaction between demand and supply sides that determines the performance of the transport system.

A quantification of existing or 'base year' (2008) transport demands is needed to allow the understanding of:

- current demand and supply;
- current conditions of travel; and
- any weaknesses in infrastructure, services and systems.

However, to prepare the General Transport Master Plan we need also to understand how and to what degree the situation we currently see will change in the future.

On the supply side we need to be aware of what changes to network infrastructure and services are going to occur regardless of the outcomes of any recommendations made in the final plan, this is known as the "Do-Minimum" situation. In transport appraisal these schemes are called 'committed' schemes.

On the demand side we need to predict future change in terms of:

- growth in demand for the movement of people and materials;
- the geographic distribution of that demand – that is will origins and destinations of travel be different?; and
- the modes of transport people and the suppliers of materials will chose to use.

Each of these demand side changes will be influenced by factors related to:

- Economics;
- National Demographics;
- Regional Development; and
- Transport Costs (the absolute and relative cost of transport by different modes).

Demand can of course also be affected by geo-political factors. While these are not possible to predict, they can be reflected in the assumptions defining future scenarios.

The analysis of future conditions has been undertaken using transport models developed for the project and forecasts made for two future years:

- 2015 to represent the year by which projects funded under the 2007-2013 Operational Programme for Transport will be implemented; and
- 2030 providing an estimate of the longer term demand.

This chapter discusses the principles of passenger and freight transport modelling and demand forecasting, factors affecting demand growth, and growth assumptions for the future year baseline scenario.

3.2 Model Structure

The Bulgaria Transport Model (BTM) is a large-scale, inter-urban, multi-modal model comprising both elements of people movement and also the movement of freight. It has been developed to allow the testing of the impact of significant improvements to transport infrastructure in Bulgaria.

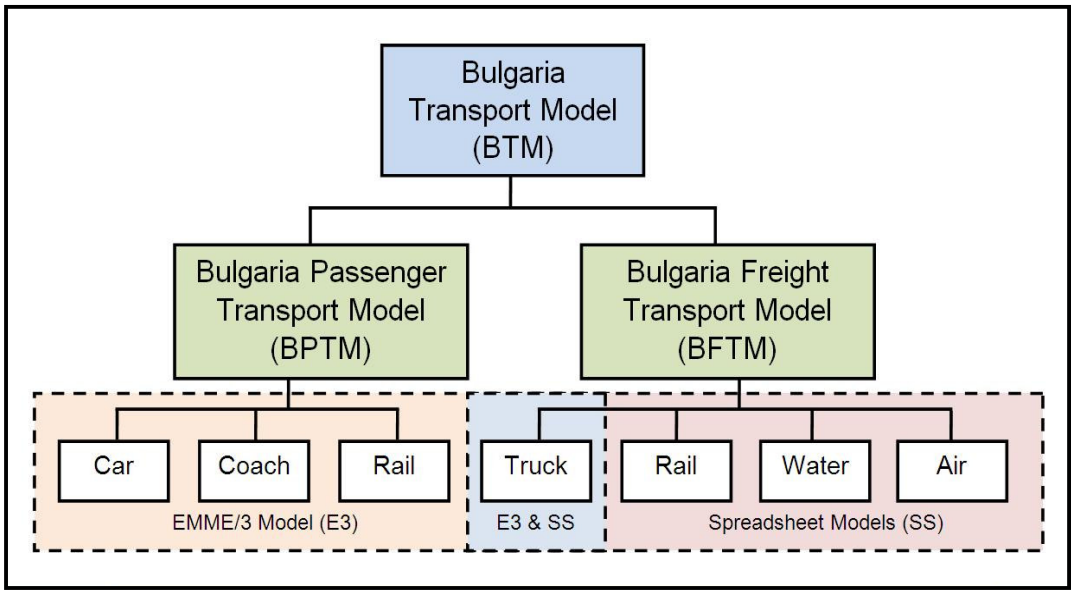
The model is required to provide analysts with a sound estimate of patterns of existing demand and infrastructure (the Base Year case), to forecast likely changes in patterns of demand over time, and to predict the impact of and benefits associated with any proposed transport schemes.

The model is supported by extensive data collection. New data collection has been necessary due to a lack of significant existing data sources for Bulgaria. Surveys have been conducted across the country to

determine patterns of travel by private vehicle, rail and coach, interviewing travellers and counting people and vehicles.

Figure 3.1 shows the integration and linkages between the different elements of the BTM

Figure 3.1 – Structure of the Bulgaria Transport Model



We adopted the following overall modelling approach in support of the development of the BTM:

- We undertook a large-scale data collection exercise, including new surveys as well as collecting published information, all of which have formed the basis of a sound technical dataset;
- We have developed a large-scale multi-modal modelling package, the Bulgaria Transport Model (BTM), which covers two main modelling elements, the Bulgaria Passenger Transport Model (BPTM) and the Bulgaria Freight Transport Model (BFTM);
- Based on the extensive data collected, we developed a large-scale multi-modal passenger transport model using EMME, a state-of-the-art transport planning software package.
- The EMME model covers passenger journeys (car, rail, coach and ferry) wholly within Bulgaria, international journeys with their origin or destination in Bulgaria, and transit trips. This is complemented by separate spreadsheet-based models for the analysis and forecasts of air and maritime passenger travel;
- A spreadsheet-based model has been developed for the modelling of freight movements by different transport modes (road, rail, water and air), for both domestic and international goods movements (Imports, Exports and Transit);
- The model has a validated 2008 base year and forecasting year models for 2015 and 2030;
- The model enables the assessment of transport demand and network supply taking into account economic and demographic changes, and logical linkages between economic/demographic change and overall transport demand; and
- The model allows for the full assessment of changes in infrastructure provision, changes in public transport services, and a range of policy scenarios to inform the development of the Bulgaria General Transport Master Plan.

Further details of the development of the BTM are provided in Appendix B.

3.3 Sources of Data for Current Transport Demand

3.3.1 Highway Demand Data

The main sources of highway demand data are:

- Road Side Interview (RSI) and Manual Classified Count (MCC) surveys as part of the study;
- Bulgaria highway census survey Annual Average Daily Total (AADT) trip data; and
- Statistics published in National Statistics Institute (NSI) year books.

In total RSI surveys and the accompanying MCC counts were undertaken at 41 sites. Additional MCC's were collected at a further 26 sites.

In addition, highway travel statistics at an aggregate level are available from the Bulgarian National Statistical Institute yearbooks. NSI yearbooks were obtained for the years 2000-2006 during the study.

3.3.2 *Rail Demand Data*

Rail demand data has principally been derived from BDZ station-to-station ticket sales data provided to AECOM for the month of March 2008.

In addition to this, as part of the study, surveys were carried out at six key railway stations across the country.

The NSI yearbooks also contain information useful for rail demand analysis, including total yearly passengers carried and passenger kilometres travelled.

3.3.3 *Coach Demand Data*

Coach demand data has principally been derived from surveys carried out at six key coach stations across the country:

The NSI yearbook also contains information useful for coach demand analysis, including total yearly passengers carried and passenger kilometres travelled, divided by urban buses and long-distance coaches.

3.3.4 *Air Demand Data*

The main source of air demand is Marketing Information Data Transfer (MIDT) data, which is an air passenger booking database.

Monthly MIDT data were obtained for the period between January 2007 and December 2007 for Sofia, Burgas, Varna and Plovdiv Airports.

In addition air passenger surveys were carried out at Sofia airport and our analysis is also supported by statistical data and forecasts provided by the Bulgarian Ministry of Transport and the CAA.

3.3.5 *Freight Demand Data*

The information for road, rail, river, ports, and air freight data came from many sources. The following is a description of each transport mode and the data sources used including the time period the data covers.

- Road
  - Road Side Interviews (2008) (Locations as in the highway model)
  - Traffic Counts (2008) (Locations as in the highway model)
  - Border Crossing data from 12 sites (2007)
  - National Road Freight Statistics (2000 – 2007)
  - Eurostat; Freight vehicle / kilometres and empty running data (2007)
- Rail
  - BDZ is the largest train/freight operator in Bulgaria and they provided data on freight terminal activity.
  - National Statistics; National Rail Freight Totals (2000 – 2007)
- River
  - National Statistics; data including and excluding roll-on roll-off (2003 – 2007)
  - Detailed statistics for the Port of Lom (2008)
- Ports
  - National Statistics (2003 – 2007)
  - Detailed Statistics for the Port of Burgas (2005 - 2007)
  - Eurostat – Competing port statistics including container volumes
- Air
  - Eurostat

3.4 Global Economic Crisis

A very important factor affecting all forecasts of future demand occurred in the second half of 2008. That was the global economic crisis, which struck the markets in the developed countries resulting in impacts that caused us to need to make significant corrections in our future year forecasts for Gross Domestic Product (GDP) growth in Bulgaria. The assumptions behind the revised forecast of GDP growth are derived from the analyses undertaken by various international institutes, e.g. the International Monetary Fund, World Bank, European Development Bank, European Commission, The Economist, and the Bulgarian National Statistical Institute together with forecasts of the Ministry of Economy, Energy and Tourism.

Before 2008 the Bulgarian economy was experiencing steady annual growth of about 6% partly due to the extensive short-term development of the construction sector. With the onset of the recession we reviewed the latest economic data and forecasts and how they were likely to affect our predictions of GDP, which is one of the principal drivers of growth in transport demand in our passenger and freight models.

The Ministry of Finance in Bulgaria produced revised GDP forecasts for 2009 and 2010 of -2.1% and 0.0% respectively. These were significant reductions on the pervious values of 0.5% and 1.7% respectively. The evidence from EBRD, IMF and the Economist Intelligence Unit was that the medium term growth rates in Bulgaria were only likely to be achieved by 2012 at the earliest. Consequently we have adopted a revision to the original forecasts of GDP.

The economic outlook for Bulgaria that we have assumed in this study can be found in **Table 3.1.**

Table 3.1 - Summary of Assumption on GDP Growth

Period	Revised Forecasts		Original Forecasts	
	Annual	Cumulative	Annual	Cumulative
2007-2008	6.00%	106.00%	6.00%	106.00%
2008-2009	-2.10%	103.77%	0.50%	106.53%
2009-2010	0.00%	103.77%	1.70%	108.34%
2010-2011	1.50%	105.33%	3.00%	111.59%
2011-2012	4.00%	109.54%	4.00%	116.05%
2012-2013	4.00%	113.93%	4.00%	120.70%
2013-2014	4.00%	118.48%	4.00%	125.52%
2014-2015	5.00%	124.41%	5.00%	131.80%
2015-2016	5.00%	130.63%	5.00%	138.39%
2016-2017	6.00%	138.46%	6.00%	146.69%
2017-2018	6.00%	146.77%	6.00%	155.50%
2018-2019	5.00%	154.11%	5.00%	163.27%
2019-2020	5.00%	161.82%	5.00%	171.43%
2020-2021	5.00%	169.91%	5.00%	180.01%
2021-2022	5.00%	178.40%	5.00%	189.01%
2022-2023	5.00%	187.32%	5.00%	198.46%
2023-2024	4.00%	194.82%	4.00%	206.40%
2024-2025	4.00%	202.61%	4.00%	214.65%
2025-2026	4.00%	210.71%	4.00%	223.24%
2026-2027	4.00%	219.14%	4.00%	232.17%
2027-2028	4.00%	227.91%	4.00%	241.45%
2028-2029	3.00%	234.74%	3.00%	248.70%
2029-2030	3.00%	241.79%	3.00%	256.16%

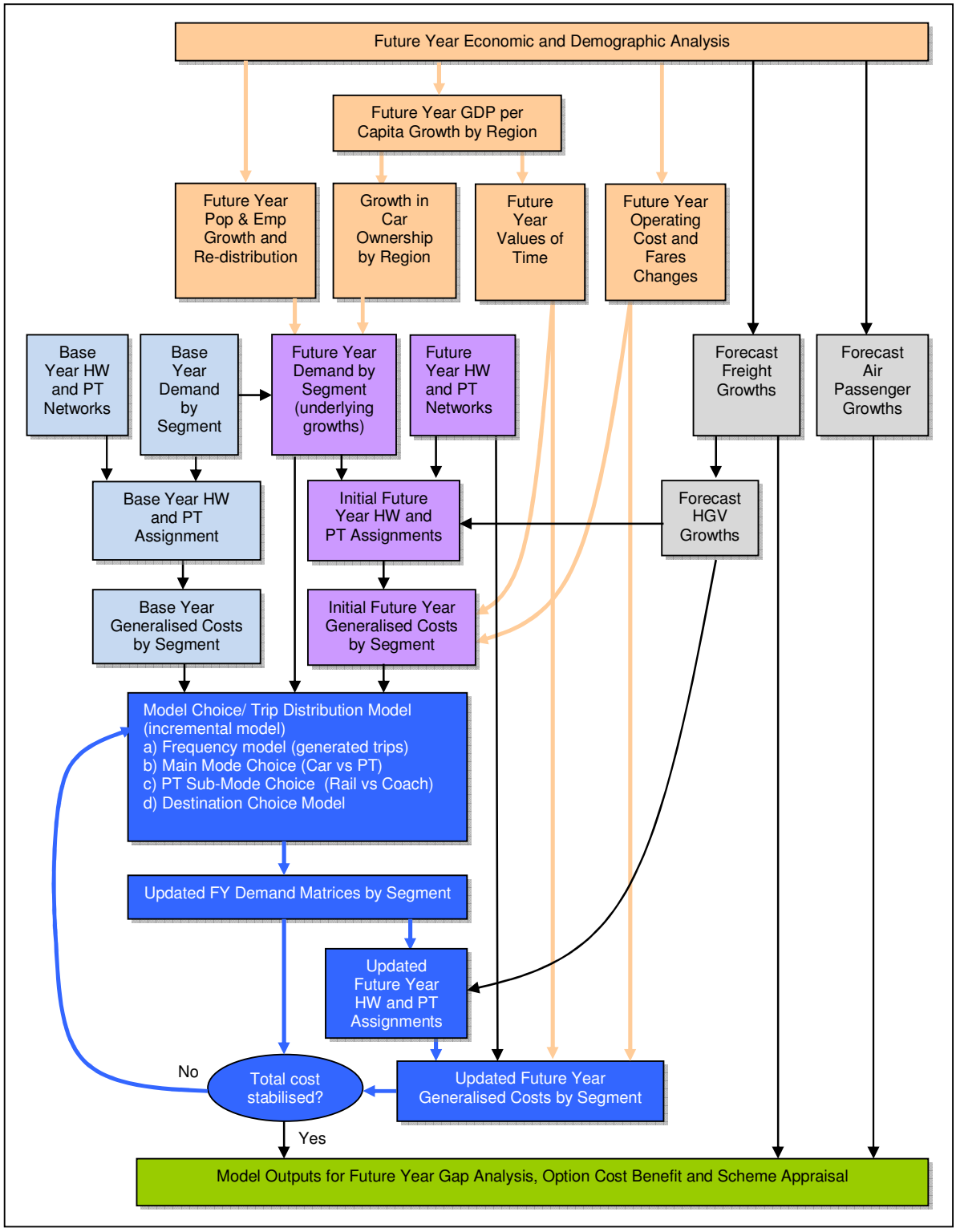
This results in a decline in cumulative GDP of 5.9% over that previous forecast for three years – 2009, 2010 and 2011. This is a reasonable assumption taking into account that Bulgarian economic growth needs Foreign Direct Investment and this will be slow to return as the primary focus will be strengthened towards home markets. These changes are reflected in the modelling of growth in demand and future year forecasts as described in the following sections.

3.5 Modelling Growth in Demand

3.5.1 *Passenger Demand Forecasting Methodology*

For the General Transport Master Plan we have developed a multi-stage model to forecast transport demand in Bulgaria and between Bulgaria and neighbouring countries. The process considers the change in economic development, change in demographic data, change in car ownership, change in transport infrastructure provision and change in travel cost to forecast the transport demand for each mode of transportation. The process is shown in summary in the flowchart in **Figure 3.2**.

Figure 3.2 – Passenger Demand Forecasting Process Flowchart



3.5.2 *Summary of Passenger Forecasting Assumptions*

The assumptions in the do-minimum scenario can be broadly classified into 4 main categories.

- Demographic assumptions - The population forecast follows the 2008 based population projection by the European Union. The forecast is for population to decline from 2008 through to 2030. Population in Bulgaria will reduce to 7.5 million by 2015 and 6.9 million by 2030.
  - As discussed before, the population in Sofia, and other agglomeration areas, and the rest of Bulgaria is expected to change at different rates.
  - Population in Sofia, the capital, is assumed to grow slightly over the forecast period. The population in the rest of the Bulgaria is assumed to fall with population falling fastest within rural areas. The national population has been controlled to the population projection made by the European Union. Similarly, employment figures are assumed to follow the same pattern as population, i.e. the total number of employed people in Sofia, the capital, is assumed to rise slightly while the employment figure in the rest of the Bulgaria is assumed to fall.
  - The total number of people employed in Bulgaria in 2008 was 3.36 million. No employment forecast for Bulgaria is available from the European Union. We have used the change in active population, derived from the population projection, to estimate the change in the number of employed people in Bulgaria.
- Network assumption - A main priority of the Bulgaria Transport Master Plan is to prioritise transport infrastructure investment in Bulgaria. On this basis, all proposed major transport schemes in Bulgaria have been the subject of evaluation in this study and form part of do-something scenarios. As described previously the network assumptions in the do minimum scenario contain only those transport infrastructure schemes present or committed in 2008.
- Economic assumptions - the principles of the economic forecasts are summarised in **Table 3.2** below.
- Cost assumption - the assumption on travel cost and public transport fares is summarised below and quantified in Table 3.2:
  - Car usage cost – the combined effect of changes are forecast to lead to a reduction of fuel cost (EURO/km) by 19% by 2015 and a reduction of 26% by 2030;
  - Car maintenance cost - The car maintenance cost is assume not to change in real terms over the forecast period;
  - Parking cost - Parking cost is assumed to remain unchanged in real terms over the forecast period; and
  - Public Transport (PT) fare (both coach and rail) – The PT fares are assumed to remain unchanged to 2015 and to increase by 1% per year from 2015 onward.

Table 3.2 below summarises all input assumptions. Prices are all quoted in 2008 values, and exclude the effect of inflation.

Table 3.2 - Summary of Inputs to Forecast Models

	2008 Base Year	Assumptions		Notes
		2015	2030	
Economic Factors				
GDP	30,782 million euro	+17%	+128%	GDP growth is given at regional level
GDP per head	4,028 euro/head	4,808eur/head (+19%)	10,201eur/head (+153%)	Passenger demand forecasting is based on GDP per head at regional level
Demographic Factors				
Total Population	7.76 million	7.49 million (or -3.5% on 2008 figure)	6.88 million (or -11.3% on 2008 figure)	Passenger demand forecasting is based on Population growth at regional level
Active Population	3.63 million	3.51 million (or -4.0% on 2008 figure)	3.20 million (or -11.8% on 2008 figure)	Passenger demand forecasting is based on growth in Active population at regional level

	2008 Base Year	Assumptions		Notes
		2015	2030	
Transport Cost				
Fuel Cost	1.28 euro/litre	1.13 euro/litre	1.23 euro/litre	Source: Consultant assumption
Vehicle Efficiency	0.0712 litres/km	0.0653 litres/km (-8.2%)	0.0546 litres/km (-23.3%)	Source: Consultant assumption
Public Transport Fares	Rail 0.0331 euro/km Coach 0.0588 euro/km	Rail 0.0331 euro/km Coach 0.0588 euro/km	Rail 0.0384 euro/km Coach 0.0947 euro/km	Source: Operator data. Discussion
Vehicle Ownership				
Vehicle Ownership	0.276 vehs/ person	0.299 vehs/person (+12%)	0. 415 vehs/person (+49%)	Passenger demand forecasting is based on growth in vehicle ownership at regional level
Transport Network				
Change in Transport Network		Include transport projects currently under construction	Include transport projects are currently under construction	Assumed that the impact of these projects on the overall demand is insignificant, and therefore not considered
Value of Time (VoT)				
VoT – Business	19.77 eurocents/min	23.42 eurocents/min	39.58 eurocents/min	Source: "Requirements for preparation of CBA in Transport sector" for Bulgarian
VoT – Non Business	7.30 eurocents/min	8.65 eurocents/min	14.61 eurocents/min	As above.

Passenger demand forecasts for the future year do-minimum scenarios, that is growth in demand but no change in supply over and above major transport infrastructure schemes that have political commitment and security of funding, are presented in Chapter 4.

3.5.3 *Freight Demand Forecasting Methodology*

Freight growth factors have been estimated for future years, so that they can be applied to the base year demand. The main aim is to facilitate a corridor analysis of the situation in 2015 and 2030. The basic methodology has been to provide freight growths based on a simplified Origin and Destination matrix. We have used a spreadsheet based approach which factors growths by origin, destination or origin-destination pair at regional level. This model provides growth levels according to regional origin / destinations and for international trips as growths according to country of origin / destination.

The growth of freight traffic in Bulgaria whether by road, rail, air or water will be affected by a range of factors. The main factors affecting freight growth can be classified into social, economic, modal share and other factors:

- Social
  - Population changes and urban migration – this is consistent with the values used for passenger demand forecasting

- Economic
  - Growth in Bulgaria's GDP
  - Growth in main freight industry and commodity groups – this is clearly linked to GDP
  - Growth in the economies of the main trade partners

- Change in trade patterns – primarily dependent on growth in GDP of the receiving country but also taking into account the change in Bulgaria's trade patterns following EU accession

- Modal Share
  - Relative cost of different modes of transport
  - Relative attractiveness of rail or water freight compared to road

- Other Factors
  - Use of larger vehicles
  - More intermodal and logistics centres
  - Border crossing problems

A significant proportion of Bulgarian freight movements especially on the railways and the River Danube are of bulk commodities for traditional heavy industries and energy supply such as coal, iron ore, aggregates, steel production and minerals. If the economy follows the trend of many other EU states then these traditional sectors will experience some decline which will affect freight tonnage and flow patterns

The forecasting methods are applied at a disaggregate level to five different commodities groups:

- Agriculture;
  - Food products
  - Forestry
  - Fishing
- Industry;
  - Mining & quarrying
  - Utilities
  - Manufacturing
  - Construction
- Wholesale & retail trade;
- Containers; and
- Other services
  - Repair services
  - Transport & storage

Split by different types of traffic:
- Domestic;
- Import;
- Export; and
- Transit.

Allocated to different modes of transport based on origin, destination and differential costs:
- Truck;
- Train;
- River boat;
- Sea ship; and
- Air freight.

3.5.4 Summary of Freight Forecasting Assumptions

3.5.4.1 Commodity Forecasts

Growth factors for the different commodity groups have been estimated for 2008 to 2015 and 2008 to 2030 based on an analysis of past and projected year on year growth based on Bulgarian and European data. For forecasting purposes Bulgaria has been divided in to 9 sectors, based around the 6 planning regions but with 3 areas split out separately because of their significantly different freight characteristics.

Forecasting assumptions in terms of Gross Value Added (GVA) for the five different commodity groups by sector are shown in **Tables 3.3** and **3.4.**

Table 3.3 - Commodity Growth Projections, 2008 to 2015

Sector/Commodity	Agriculture	Industry	Wholesale & Retail	Containers	Other
North Western	-10%	7%	11%	0%	10%
North Central	-10%	15%	19%	7%	18%
North Eastern	-3%	15%	27%	15%	26%
Sofia & Region	-3%	17%	51%	23%	48%
Blagoevgrad	-3%	15%	19%	0%	18%
Other South Western	-3%	15%	11%	0%	10%
Stara Zagora	-3%	15%	27%	7%	26%
Other South Central	-3%	17%	36%	15%	34%
South Eastern	-3%	17%	36%	15%	34%
Bulgaria	**-5.6%**	**15%**	**38%**	**14%**	**33%**

Source: AECOM estimates

Table 3.4 - Commodity Growth Projections, 2008 to 2030

Sector/Commodity	Agriculture	Industry	Wholesale & Retail	Containers	Other
North Western	-17%	76%	70%	4%	69%
North Central	-17%	96%	115%	35%	113%
North Eastern	-11%	96%	185%	74%	182%
Sofia & Region	-11%	99%	289%	107%	281%
Blagoevgrad	-11%	96%	110%	4%	108%
Other South Western	-11%	96%	70%	4%	69%
Stara Zagora	-11%	96%	166%	35%	163%
Other South Central	-11%	100%	252%	67%	246%
South Eastern	-11%	100%	252%	74%	246%
Bulgaria	**-13.3%**	**96%**	**229%**	**65%**	**211%**

Source: AECOM estimates

3.5.4.2 Types of Traffic

Domestic Traffic – Using the growth in GVA by commodity, the growth in total domestic freight was estimated based on the proportional contribution of each commodity to total freight movement. Using standard relationships for average tonnage carried for different commodities and a furnessing process growth in the number of trips has been derived for the sector to sector matrix for Bulgaria. **Tables 3.5 and 3.6** show growth matrices for 2008 to 2015 and for 2008 to 2030 for total domestic freight moved.

Table 3.5 – Domestic Freight Growth Matrix, 2008 to 2015

Origin/Destination	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
North Western (NW)	-1%	1%	3%	9%	1%	-4%	0%	3%	4%
North Central (NC)	2%	5%	6%	11%	5%	-7%	4%	6%	8%
North Eastern (NE)	4%	6%	8%	9%	7%	-7%	6%	8%	9%
Sofia & Region (S&R)	8%	11%	9%	22%	13%	6%	12%	15%	3%
Blagoevgrad (B)	1%	4%	6%	13%	5%	1%	4%	7%	7%
Other Sth West (OSW)	-5%	-7%	-7%	7%	1%	-3%	-4%	2%	-6%
Stara Zagora (SZ)	1%	4%	6%	13%	5%	-4%	2%	5%	6%
Other Sth Central (OSC)	3%	6%	8%	16%	8%	2%	5%	10%	8%
South Eastern (SE)	-1%	1%	3%	9%	1%	-4%	0%	3%	4%

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Table 3.6 – Domestic Freight Growth Matrix, 2008 to 2030

Origin/Destination	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
North Western (NW)	32%	38%	35%	59%	39%	40%	34%	46%	46%
North Central (NC)	39%	45%	52%	66%	47%	52%	45%	48%	52%
North Eastern (NE)	37%	52%	60%	66%	54%	56%	51%	57%	61%
Sofia & Region (S&R)	59%	65%	64%	96%	69%	39%	66%	78%	56%
Blagoevgrad (B)	37%	43%	50%	68%	44%	32%	41%	53%	51%
Other Sth West (OSW)	39%	52%	55%	43%	33%	5%	42%	39%	56%
Stara Zagora (SZ)	33%	43%	49%	67%	44%	44%	28%	42%	51%
Other Sth Central (OSC)	46%	48%	56%	80%	55%	41%	42%	64%	61%
South Eastern (SE)	32%	38%	35%	59%	39%	40%	34%	46%	46%

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Import Traffic – projected growth in international freight export traffic is related to the GDP of Bulgaria and its trading partners and anticipated trade patterns. **Tables 3.7** and **3.8** show growth matrices for 2008 to 2015 and for 2008 to 2030 for imported freight.

Table 3.7 – Import Freight Growth Matrix, 2008 to 2015

Destination / Origin	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
Romania	26%	21%	26%	28%	21%	-7%	18%	20%	26%
Greece	19%	20%	21%	32%	29%	3%	8%	28%	28%
Macedonia	28%	26%	25%	8%	44%	41%	-1%	27%	24%
Turkey	19%	20%	14%	35%		3%	29%	32%	31%
Germany	27%	22%	17%	36%		28%	30%	34%	2%
Italy	30%	26%	30%	33%	30%	25%	29%	27%	25%
Ukraine	-4%	-2%	-4%	40%		-8%	12%	25%	16%
Russia & Baltic	8%	29%	5%	30%	13%	-8%	10%	25%	-1%
Western Europe	23%	28%	3%	10%		-8%	30%	27%	-7%
Eastern Europe	12%	3%	0%	17%	16%	-8%	8%	17%	0%
Central Europe	7%	5%	2%	16%	8%	-7%	13%	10%	12%
Middle East		28%	6%					30%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Table 3.8 – Import Freight Growth Matrix, 2008 to 2030

Destination / Origin	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
Romania	81%	82%	99%	101%	66%	59%	59%	73%	82%
Greece	66%	66%	67%	112%	94%	72%	52%	90%	90%
Macedonia	89%	75%	86%	86%	126%	123%	62%	86%	86%
Turkey	62%	63%	60%	117%		92%	102%	107%	110%
Germany	87%	66%	52%	116%		90%	94%	113%	76%
Italy	94%	89%	94%	112%	94%	78%	92%	88%	88%
Ukraine	0%	6%	0%	111%		59%	50%	65%	60%
Russia & Baltic	14%	99%	37%	105%	65%	59%	46%	87%	6%
Western Europe	88%	90%	7%	88%		61%	94%	91%	43%
Eastern Europe	64%	30%	16%	105%	82%	61%	69%	86%	8%
Central Europe	26%	20%	18%	95%	71%	63%	76%	85%	77%
Middle East		90%	39%					94%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Export Traffic – projected growth in international freight export traffic is related to the GDP of Bulgaria's main trading partners and anticipated trade patterns. **Tables 3.9** and **3.10** show growth matrices for 2008 to 2015 and for 2008 to 2030 for exported freight.

Table 3.9 – Export Freight Growth Matrix, 2008 to 2015

Origin / Destination	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
Romania (R)	56%	44%	48%	54%	51%	-6%	44%	43%	57%
Greece (Gr)	4%	5%	5%	17%	12%	-4%	5%	12%	12%
Macedonia (M)	19%	22%	18%	0%	32%	28%	-3%	22%	18%
Turkey (T)	8%	8%	10%	22%		-13%	20%	22%	20%
Germany (Ge)	6%	6%	2%	21%		13%	14%	19%	-2%
Italy (I)	11%	10%	11%	16%	11%	11%	11%	11%	9%
Ukraine (U)	-1%	11%	-1%	19%		-8%	13%	3%	13%
Russia & Baltic (RB)	13%	25%	13%	24%	13%	-9%	13%	17%	17%
Western Europe (WE)	8%	8%		-6%		-8%	8%	8%	1%
Eastern Europe (EE)	13%	11%	5%	12%	10%	-9%	9%	18%	0%
Central Europe (CE)	13%	6%	3%	15%	4%	-8%	9%	12%	10%
Middle East (ME)		20%	15%					20%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Table 3.10 – Export Freight Growth Matrix, 2008 to 2030

Origin / Destination	NW	NC	NE	S&R	B	OSW	SZ	OSC	SE
Romania (R)	128%	109%	116%	118%	78%	60%	73%	92%	103%
Greece (Gr)	34%	34%	34%	71%	55%	58%	63%	55%	55%
Macedonia (M)	83%	84%	84%	77%	122%	115%	60%	88%	84%
Turkey (T)	93%	93%	83%	152%		8%	142%	141%	141%
Germany (Ge)	23%	20%	13%	53%		36%	35%	52%	50%
Italy (I)	16%	16%	17%	34%	16%	25%	16%	17%	24%
Ukraine (U)	0%	91%	4%	115%		59%	65%	63%	69%
Russia & Baltic (RB)	71%	101%	72%	95%	65%	59%	72%	66%	89%
Western Europe (WE)	35%	35%		58%		58%	35%	34%	74%
Eastern Europe (EE)	35%	12%	40%	90%	90%	56%	76%	119%	8%
Central Europe (CE)	47%	29%	28%	63%	47%	57%	51%	69%	59%
Middle East (ME)		89%	77%					94%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Transit Traffic – being freight movement with both the origin and destination outside Bulgaria but which transits through the country. Projected growth in international freight transit traffic is related to the receiving countries GDP and anticipated trade patterns. **Tables 3.11** and **3.12** show growth matrices for 2008 to 2015 and for 2008 to 2030 for transiting freight.

Table 3.11 – Transit Freight Tonnage Growth Matrix, 2008 to 2015

Destination Origin	R	Gr	M	T	Ge	I	U	RB	WE	EE	CE	ME
Rom. (R)		19%	61%	40%	0%	0%				0%	32%	38%
Greece (Gr)	62%		61%		9%		22%	37%	8%	59%	32%	
M'donia (M)	67%	23%		44%					0%	63%	36%	
Turkey (T)	62%		61%		9%	7%	22%	37%	8%	59%	32%	0%
Germany (Ge)	0%	19%		40%				0%	9%	0%		38%
Italy (I)	0%			40%								0%
Ukraine (U)		25%		47%							32%	
Rus/Balt (RB)		19%		40%	0%						13%	
W Europe (WE)	62%	19%	0%	40%						59%		
E Europe (EE)	0%	19%	61%	40%	9%				8%			0%
C Europe (CE)		19%	61%	40%				0%				38%
Mid East (ME)	62%			0%	9%	0%				59%	32%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

Table 3.12 – Transit Freight Growth Matrix, 2008 to 2030

Destination Origin	R	Gr	M	T	Ge	I	U	RB	WE	EE	CE	ME
Romania (R)		53%	91%	120%	0%	0%				0%	0%	94%
Greece (Gr)	101%		91%		33%		122%	80%	35%	106%	46%	
M'donia (M)	121%	65%		140%					0%	121%	65%	
Turkey (T)	120%		108%		47%	27%	142%	97%	46%	116%	70%	0%
Germany (Ge)	0%	53%		119%				0%	0%	0%		94%
Italy (I)	0%			127%								0%
Ukraine (U)		92%		180%							0%	
Rus/Balt (RB)		55%		127%	0%						0%	
WEurope(WE)	0%	56%	0%	126%						108%		
E Europe (EE)	0%	53%	91%	115%	35%				35%			0%
C Europe(CE)		48%	91%	127%				0%				94%
Mid East (ME)	108%			0%	35%	0%				108%	56%	

Source: AECOM estimates (includes road freight, rail freight and inland water freight)

3.5.4.3 Mode of Freight Transport

The relative growth in transport of freight both domestically and internationally by different modes will be a function of factors associated with the relative cost, speed and convenience of the alternatives and the change in commodities carried and their suitability for transport by the different modes.

Our best estimate of these factors has been incorporated in to the freight model to produce projections of growth by mode from 2008 to 2015 and 2008 to 2030.

Table 3.13 – Growth in Freight Transport by Mode

	2008 to 2015	2008 to 2030
Truck	11%	83%
Train	15%	94%
Sea Ship	6%	59%
River Boat	8%	59%
Aeroplane	19%	86%

Source: AECOM estimates

4 Transport Demand

4 Transport Demand

4.1 Introduction

The passenger and freight transport models described in Chapter 3 were used to prepare forecasts of passenger and freight traffic in Bulgaria. The results for baseline scenarios, using the stated assumptions and no change in networks or services over and above that which is already committed, are provided in the following sections.

4.2 Existing Passenger Transport Demand

4.2.1 Historic Growth in Passenger Trips

Statistics from the annual traffic census and from NSI Statistics show different growth trends for different ground passenger transport modes:

- Car (represented by average traffic flows) = +6.5% per year from 2000 to 2007
- Bus and Coach (represented by passengers carried) = -5.4% per year from 2002 to 2006
- Rail (represented by passengers carried) = +0.3% per year from 2002 to 2006

4.2.2 Domestic Passenger Transport Demand

Using the data sources referenced in Chapter 3, aggregated to Bulgaria's major planning regions, the tables below present current (2008) inter-urban passenger journeys by car, coach and rail.

Table 4.1 - Sector-Sector Car Demand (Average 12-Hour Weekday Person Trips - 2008)

Region	North Central	North East	North West	South Central	South East	South West
North Central	122,834	5,972	3,659	3,759	1,986	2,527
North East	6,335	300,479	285	1,125	3,807	666
North West	3,613	233	23,442	719	154	8,786
South Central	3,710	1,032	802	394,827	7,408	14,024
South East	2,044	3,455	142	7,381	95,799	1,301
South West	2,493	683	8,826	12,050	1,649	1,495,373

Source: AECOM matrix estimation based on RSI surveys and MCCs

Table 4.2 - Sector-Sector Coach Demand (Average 12-Hour Weekday Person Trips - 2008)

Region	North Central	North East	North West	South Central	South East	South West
North Central	20,754	2,387	1,473	1,351	737	1,520
North East	2,442	31,550	62	283	1,934	1,372
North West	1,487	51	5,859	181	38	3,492
South Central	1,333	280	189	47,395	2,878	6,516
South East	722	1,862	32	2,871	16,434	1,803
South West	1,506	1,376	3,472	5,689	1,914	100,782

Source: Estimated from analysis of study coach survey data

Table 4.3 - Sector-Sector Rail Demand (Average 12-Hour Weekday Person Trips - 2008)

Region	North Central	North East	North West	South Central	South East	South West
North Central	7,761	657	221	362	14	746
North East	631	6,061	64	325	298	564
North West	259	68	5,327	49	24	1,349
South Central	362	334	42	17,405	785	2,014
South East	27	287	25	781	2,446	429
South West	710	429	1,319	1,966	306	17,110

Source: BDZ Rail ticket sales data

This demonstrates the dominance of the car mode in Bulgaria for inter-urban passenger journeys:

- Car – 88.0%
- Coach – 9.5%
- Rail – 2.5%

4.2.3 *International Passenger Trips*

Approximately 11.7 million foreign trips were made in 2006. Of these approximately 8.3 million (70%) travelled in to or out of the country by road, 3.0 million (25%) by air and 0.4 million by rail (5%). An insignificant number arrived or departed by water (Black Sea or Danube ports).

Of the total of 11.7 million foreign trips, 7.5 million were made by foreigners visiting Bulgaria and 4.2 million by Bulgarians travelling abroad. This is a 7.8% and 7.0% growth per year respectively from 2002 to 2006.

4.2.4 *Airport traffic volumes and growth*

Bulgarian air passenger traffic is concentrated at Sofia, Varna and Burgas airports. These three airports accounted for over 98% of all scheduled and charter passenger traffic using Bulgarian airports in 2007.

Passenger numbers for 2007 were as follows:

- Sofia – 2,738,222 (43.7%)
- Burgas – 1,941,311 (31.0%)
- Varna – 1,478,093 (23.6%)
- Plovdiv – 104,130 (1.7%)
- Gorna Oryahovitsa – 301 (0.0%)

Of the total passengers across all airports (6,262,057) the vast majority were international trips with only 3% being on internal domestic flights.

The top five international destinations for passengers departing from Bulgarian airports are:

- Germany – 18.1%
- United Kingdom – 15.0%
- Italy – 10.1%
- Spain – 7.2%
- Austria – 6.3%

Growth in air passenger numbers has been very high in recent years. Between 1999 and 2007 the per annum growth in passenger numbers at each airport have been:

- Sofia – 10.5%
- Burgas – 23.7%
- Varna – 14.2%
- Plovdiv – 12.2%

4.3 Existing Domestic Freight Transport

4.3.1 *By Origin – Destination*

The Table below shows the total tonnages (loaded/lifted) of domestic freight carried by road and rail originating in the six planning regions of Bulgaria in 2007.

Table 4.4 - Domestic Road and Rail Freight Loaded by Region - 2007

Region From	Road – Total Tonnes Lifted	Rail - Total Tonnes Lifted
North Central	14,285,000	1,213,518
North East	21,114,200	736,334
North West	4,157,000	1,311,510
South Central	30,867,400	2,981,378
South East	16,835,300	3,217,732
South West	40,869,200	5,374,409
Total Tonnes Lifted	**128,128,100**	**14,834,881**

Source: NSI Statistics and BDZ data

4.3.2 *By Mode*

Road freight is most widely used for domestic transport, accounting for 89% of tonnes lifted; however, rail transport accounts for a much more significant share of domestic tonne-kms as rail freight journeys are on average 8 times longer than road freight journeys (331 km vs. 41km).

Transport by the Danube accounts for just over 1% of domestic tonnage.

Table 4.5 - Tonnes Moved by Mode: Domestic - 2006

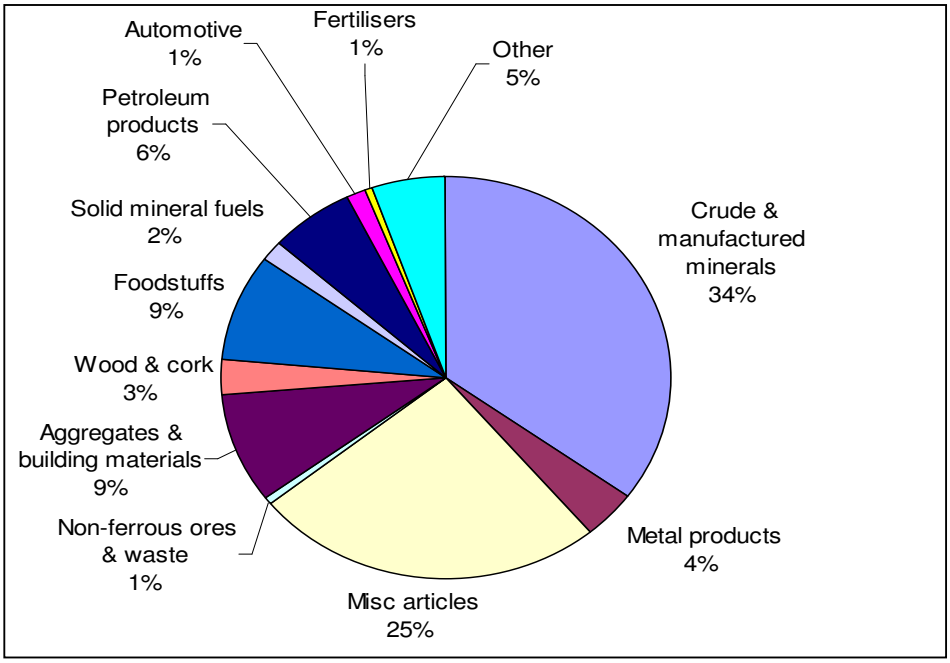
	Mode	Thousand Tonnes	Million Tonne-kms
Domestic	**River**	2,034	Not known
	Rail	16,281	5,396
	Road	142,765	5,806

Source: NSI Statistics

4.3.3 *By Commodity*

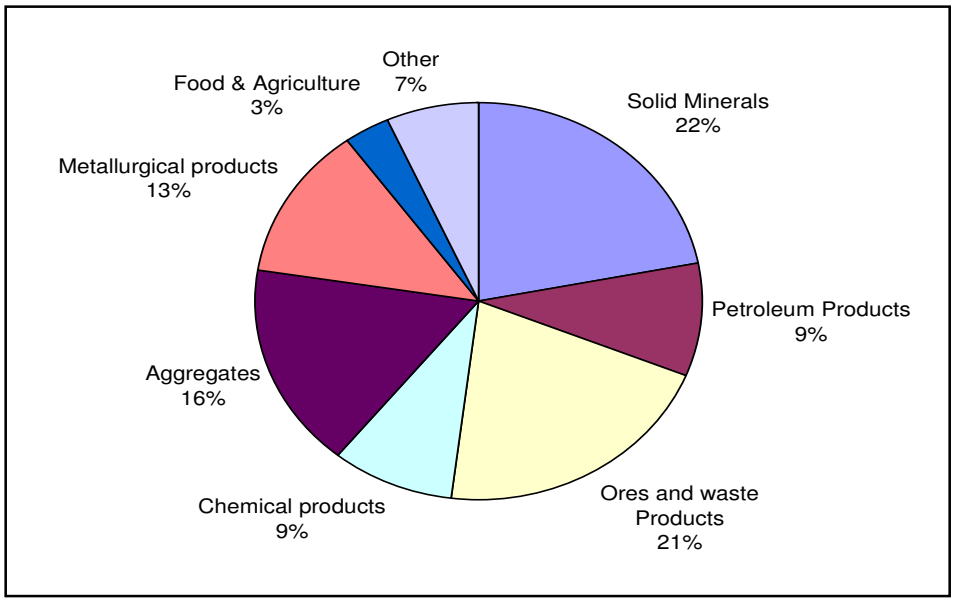
The two charts below show the proportions of different commodities carried by road and rail freight respectively.

Figure 4.1 - Road Freight Split by Commodity, 2007



Source: NSI Statistics

Figure 4.2 - Rail Freight by Commodity



Source: BDZ EAD 2006

4.4 Existing International Freight Transport

4.4.1 *By Origin / Destination*

The table below shows the top 10 import and export countries disaggregated by mode of transport in 2007.

Table 4.6 - Top Ten Importers and Exporters to and from Bulgaria 2007

	Ports (Black Sea)		Air	Rail		Road		River Danube	
	Import From	Export To	(combined)	Import From	Export To	Import From	Export To	Import From	Export To
1	Russia	Turkey	Germany	Romania	Greece	Greece	Greece	Ukraine	Germany
2	Ukraine	Singapore	Italy	Greece	Romania	Germany	Germany	Romania	Romania
3	Turkey	Italy	Hungary	Serbia	Turkey	Macedonia	Italy	Austria	Austria
4	Brazil	Slovenia	Austria	Hungary	Macedonia	Italy	France	Serbia	Croatia
5	USA	Greece	Russia	Macedonia	Serbia	Romania	Romania	Slovakia	Ukraine
6	Vietnam	Georgia	France	Czech R.	Belgium	Serbia	Turkey	Germany	Serbia
7	Romania	Ukraine	Slovenia	Austria	Hungary	Turkey	Austria	Hungary	Hungary
8	Morocco	Spain	Turkey	Russia	Slovenia	Austria	Macedonia	Greece	Slovakia
9	Chile	USA	Czech R.	Turkey	Russia	Hungary	Slovenia	Turkey	Turkey
10	Syria	Syria	UK	Croatia	Bosnia	Czech R.	Russia	Bosnia	Switzerland

Sources: MoT, BDZ and NSI Statistics

4.4.2 *By Mode*

The Table below shows for 2007 the volumes of imports, exports and transit freight by mode.

Table 4.7 - Tonnes Moved by Mode: International - 2007

	Imports	Exports	Transit	Total
Road	2,323,000	3,330,000	1,012,000	**6,665,000**
Rail	2,380,000	2,115,000	1,262,000	**5,757,000**
River	3,573,000	836,000	21,000	**4,430,000**
Sea Port	16,120,000	9,299,000	65,000	**25,485,000**
Air	10,000	8,000	0	**18,000**
Total	**24,406,000**	**15,588,000**	**2,360,000**	**42,355,000**

Sources: MoT, BDZ and NSI Statistics

4.4.3 *By Commodity*

The Table below shows for 2007 the top 10 export and import commodities by value.

Table 4.8 – Proportions of Export and Import Commodities by Value

	Import		Export	
Rank	Commodity	%	Commodity	%
1	Machinery & Transport Equipment	29.5	Manufactured Goods	29.3
2	Manufactured Goods	20.6	Misc. Manufactured Articles	18.7
3	Mineral Fuels & Lubricants	19.9	Machinery & Transport Equipment	14.9
4	Chemical & Related Products	8.8	Mineral Fuels & Lubricants	14.7
5	Crude Materials (except fuel)	7.4	Chemical & Related Products	7.8
6	Misc. Manufactured Articles	7.1	Crude Materials (except fuel)	6.7
7	Food & Live Animals	4.5	Food & Live Animals	5.6
8	Commodities & Transactions	1.0	Beverages & Tobacco	1.8
9	Beverages & Tobacco	0.8	Animal & Vegetable Oils & Fats	0.3
10	Animal & Vegetable Oils & Fats	0.3	Commodities & Transactions	0.2

Source: NSI Statistics

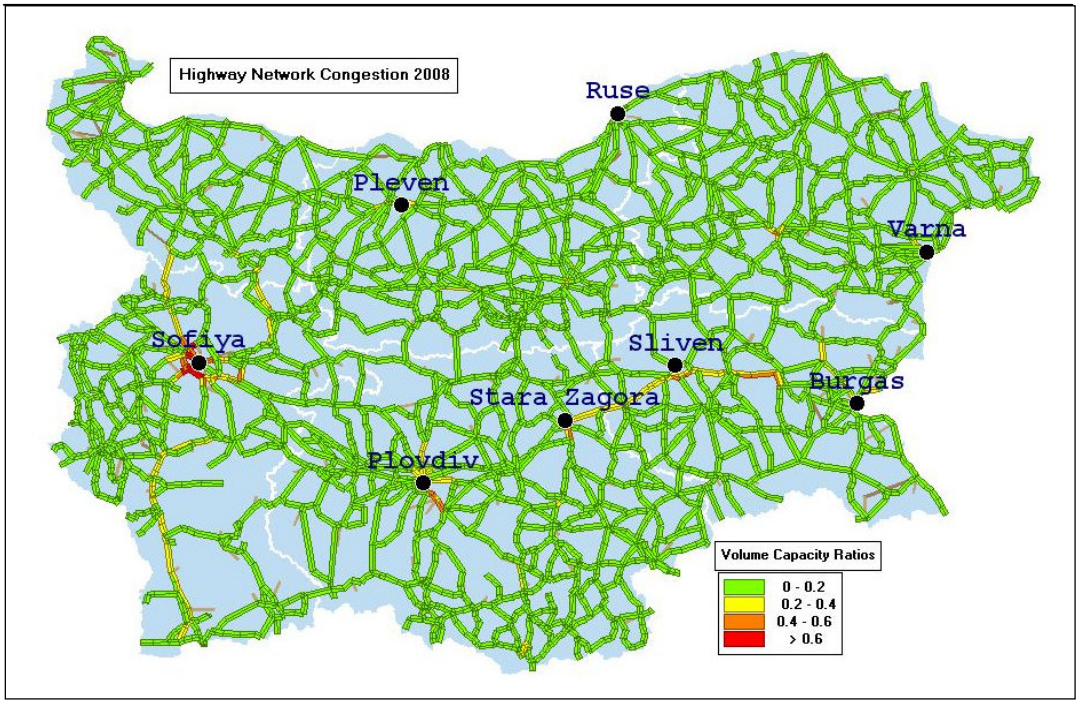
4.5 Existing Transport Network Capacity

4.5.1 *Highway Capacity*

Highway traffic volume as a proportion of approximate road capacity, in the 2008 base traffic model is illustrated in **Figure 4.3**.

The colour of the band represents the ratio of traffic flow to traffic capacity over a 12 hour period 0700 to 1900 on each link represented in the model. Green links are indicative of no problem of capacity; red links indicate roads where the flow is over 60% of the link's theoretical capacity. This demonstrates that, there are some potential capacity problems on roads around Sofia and Plovdiv and on the route between Stara Zagora and Burgas. There are no significant problems elsewhere on the country's network.

Figure 4.3 – Highway Network Congestion 2008



Source: Bulgaria Transport Model (BTM)

4.5.2 *Rail Capacity*

From data supplied by NRIC, BDZ and collected through transport surveys together with outputs from the transport models we have been able to prepare a review of existing and potential future infrastructure and service capacity constraints. This has been done through a high-level measurement of the usage made of the core network by passenger and freight services.

System operation is a function of both infrastructure and train operations and it is possible to derive a relative route assessment of how capacity is utilised throughout the core network.

Table 4.9 below shows the results of this analysis. For each route on the core network operational flexibility, capability and the density of use made by rail services on the section has been estimated. A further assessment has been made of asset condition. These factors, when combined provide a good understanding of relative route capability. Thus, when a route has a high degree of operational flexibility and capability with a good asset condition and low train and passenger usage, it is possible to conclude that capacity could exist to accommodate increases in service demand.

The analysis takes observed or given values for various operational criteria. A score is then assigned to each criterion based on an assumed impact on system capacity. A total value is calculated for each route which is defined as the capacity index. The routes are then ordered according to the capacity index given.

Table 4.9 – Route Capacity Index

Route		Operational flexibility	Operational capability	Operational density	Asset condition	Route capacity index
To	From	% of single track	Average speed (kph)	Train movements per track km per 12 hour period	% of route under significant TSR	Rank Worst to Best
Sofia	Pernik	100%	26	0.8	32.5	**24**
Sofia	Dimitrovgrad	100%	40	1	2.1	**20**
Sofia	Pernik (via Raz)	100%	62	0.9	27.9	**19**
Plovdiv	Mihaylovo	100%	50	0.9	26.9	**19**
Gorna	Stara Zagora	100%	32	0.1	5.4	**19**
Zimnitsa	Karnobat	0%	29	2.6	11.3	**19**
Stara Zagora	Zimnitsa	57%	40	0.8	20.6	**16**
Ruse	Kaspichan	100%	46	0.1	3.7	**15**
Plovdiv	Svilengrad	100%	36	0.3	5.8	**15**
Mihaylovo	Stara Zagora	0%	31	6.9	0.5	**15**
Sindel	Varna	0%	58	1	2.1	**14**
Mezdra	Vidin	100%	52	0.1	1.7	**14**
Pernik	Kulata	100%	50	0.2	8.1	**14**
Karnobat	Burgas	0%	60	0.9	2.3	**14**
Sofia	Mezdra	0%	46	0.6	1.7	**11**
Kaspichan	Sindel	0%	69	0.6	1.6	**10**
Sofia	Plovdiv	0%	52	0.6	4.9	**10**
Gorna	Ruse	100%	59	0.2	0.2	**10**
Mezdra	Pleven	0%	66	0.3	4.8	**9**
Gorna	Kaspichan	0%	66	0.1	1.5	**9**
Sindel	Karnobat	0%	59	0.1	5.7	**9**
Pleven	Gorna	0%	48	0.3	0.5	**6**

Capacity index score	Positive impact	Neutral Impact	Negative impact
	1	2	6
% of single track	0% to 20% single line	20% to 35% single line	Above 35%
Average speed	Ave speed > 50 kph	Ave speed 35 - 50 kph	Ave speed < 35 kph
Train movements per track km per 12 hr	< 0.5 movements	0.5 - 0.75 movements	> 0.75 movements
% of route under significant Temporary Speed Restriction	No TSR's	Up to 1% under TSR	> 1% under TSR

4.6 Forecasts of Passenger Demand

The assumptions in Section 3.5.2 have been incorporated in to the Transport Models to produce forecasts of passenger demand for land-based travel for the future test years (2015 and 2030). The forecasts reflect the changes in those influencing factors set out in **Table 3.2**:

- Economic changes (principally GDP);
- Demographic changes (total and economically active population);
- Transport costs (absolute and relative between competing modes);
- Vehicle ownership; and
- Changes in the transport network and services.

Tables 4.10 to 4.12 present forecasts of domestic inter-urban passenger transport demand by mode for a future do-minimum scenario where the only changes to the transport system are schemes which are major transport infrastructure schemes currently (2010) under construction or with financial and political commitment for completion before 2015, these are:

- **Vidin – Calafat Bridge** – a combined road and rail bridge over the River Danube in the North West of the Country, providing a second fixed crossing of the River between Bulgaria and Romania along the line of Trans-European Corridor IV linking Germany with Turkey and Greece. Construction started in 2007 and is due for completion in 2011.
- **Lyulin Highway** – a new dual two lane motorway with a length of 19 kms connecting the Struma Highway from its current northern termination to the east of Pernik with the Sofia Ring Road to the west of the city. Started in 2006 and due for completion in 2012.
- **Plovdiv to Svilengrad Railway Electrification and Modernisation** – Originally funded through the ISPA programme and now through the Operational Programme for Transport (OPT) the project will improve the speed, efficiency and reliability of rail passenger and freight services along the route between Plovdiv and the Turkish Border.
- **Port Varna and Burgas – new container terminals**

Table 4.10 – Domestic Car Trip Totals, Do Minimum Case (12-Hour Weekday)

Region	2008	2015	2030
North Central	140,736	138,763	146,019
North East	312,697	316,038	352,245
North West	36,946	36,238	37,517
South Central	421,803	431,116	494,769
South East	110,121	112,789	129,295
South West	1,521,074	1,651,103	2,069,699
Bulgaria	**2,543,378**	**2,686,047**	**3,229,544**

Source: Bulgaria Transport Model

Table 4.11 – Domestic Coach Trip Totals, Do Minimum Case (12-Hour Weekday)

Region	2008	2015	2030
North Central	28,221	27,073	25,338
North East	37,644	36,435	34,917
North West	11,109	10,638	9,903
South Central	58,591	56,922	55,120
South East	23,724	23,073	22,432
South West	114,739	116,615	121,247
Bulgaria	**274,027**	**270,757**	**268,957**

Source: Bulgaria Transport Model

Table 4.12 – Domestic Rail Trip Totals, Do Minimum Case (12-Hour Weekday)

Region	2008	2015	2030
North Central	9,761	9,330	8,650
North East	7,943	7,683	7,341
North West	7,076	6,744	6,205
South Central	20,942	20,286	19,483
South East	3,995	3,872	3,729
South West	21,839	22,004	22,511
Bulgaria	**71,556**	**69,919**	**67,920**

Source: Bulgaria Transport Model

As shown in **Table 4.13** the projections are for a continuing and significant growth in demand for car travel but no significant change in the numbers using public transport.

Table 4.13 – Percentage Trip Growth from 2008 to 2015 and 2030, By Mode

	2008 to 2015			2008 - 2030		
	Car	Coach	Rail	Car	Coach	Rail
North Central	-1%	-4%	-7%	4%	-10%	-11%
North East	1%	-3%	-4%	13%	-7%	-8%
North West	-2%	-4%	-8%	2%	-11%	-12%
South Central	2%	-3%	-4%	17%	-6%	-7%
South East	2%	-3%	-4%	17%	-5%	-7%
South West	9%	2%	2%	36%	6%	3%
Bulgaria	**6%**	**-1%**	**-3%**	**27%**	**-2%**	**-5%**

Source: Bulgaria Transport Model

Air passenger forecasts have been considered separately within the transport model. Forecasts presented in **Table 4.14** are based on projections for Sofia, Varna and Burgas made by the Sofia Airport Company, the Ministry of Transport, Information Technology and Communications and by FRAPORT.

Table 4.14 - Summary of Air Passenger Forecasts (Annual Total Passengers)

Airport	Flight Type	2008	2015	(% Growth)	2030	(% Growth)
Sofia	International	3,069,500	4,000,000	(130%)	7,200,000	(235%)
	Domestic	137,200	243,000	(177%)	505,100	(368%)
	Total	**3,206,700**	**4,243,000**	**(132%)**	**7,705,100**	**(240%)**
Varna	International	1,313,200	2,588,400	(197%)	3,060,100	(233%)
	Domestic	119,500	211,600	(177%)	439,900	(368%)
	Total	**1,432,700**	**2,800,000**	**(195%)**	**3,500,000**	**(244%)**
Burgas	International	1,905,500	2,973,300	(156%)	4,944,500	(259%)
	Domestic	15,100	26,700	(177%)	55,500	(368%)
	Total	**1,920,600**	**3,000,000**	**(156%)**	**5,000,000**	**(260%)**
Bulgaria Total	International	6,288,300	9,561,700	(152%)	15,204,600	(242%)
	Domestic	135,900	240,600	(177%)	500,200	(368%)
	Total	**6,424,200**	**9,802,300**	**(153%)**	**15,704,800**	**(244%)**

Source: Sofia Airport Company, the Ministry of Transport, Information Technology and Communications and by FRAPORT

Growth in passenger demand by air is forecast to be very high because it is rising from a very low base and, with increasing prosperity, air travel becomes affordable to more people. Growth in car travel whilst significant is constrained by a forecast decline in Bulgaria's population of 11% between 2008 and 2030. In contrast, in the absence of any service improvements, there is predicted to be very little growth in coach demand and a decline in rail passenger demand. Increasing prosperity and car ownership results in coach, and particularly rail, becoming less competitive with car for passenger travel unless improvements occur.

4.7 Forecasts of Freight Demand

The assumptions in Section 3.5.4 have been incorporated in to the Freight Transport Models to produce forecasts of freight demand for the future test years (2015 and 2030). The forecasts reflect the changes in those influencing factors set out in Table 3.2 to 3.4.

Tables 4.15 to 4.18 present the do-minimum forecasts for domestic, import, export and transit movements for each freight transport mode.

Table 4.15 – Forecast of Domestic Freight Movement per annum

	Measurement	2008	2015	2030
Road Truck	Lorry Equivalents	21,423,333	23,469,995	38,266,625
Rail	Lorry Equivalents	2,103,905	2,305,013	3,508,798
River Boat	Lorry Equivalents	60,247	70,235	162,891

Source: Bulgaria Transport Model

Table 4.16 – Forecast of Import Freight Movement per annum

	Measurement	2008	2015	2030
Road Truck	Lorry Equivalents	891,790	1,105,681	2,052,148
Rail	Lorry Equivalents	412,233	488,215	922,753
River Boat	Lorry Equivalents	1,004,087	1,063,888	1,436,531
Sea Ship	Tonnes	16,120,023	16,988,621	24,442,050
Aeroplane	Tonnes	10,441	12,471	19,429

Source: Bulgaria Transport Model

Table 4.17 – Forecast of Export Freight Movement per annum

	Measurement	2008	2015	2030
Road Truck	Lorry Equivalents	1,023,436	1,262,964	1,262,964
Rail	Lorry Equivalents	394,674	461,029	871,861
River Boat	Lorry Equivalents	219,853	257,497	448,140
Sea Ship	Tonnes	9,299,246	9,961,678	15,877,395
Aeroplane	Tonnes	8,298	9,911	15,441

Source: Bulgaria Transport Model

Table 4.18 – Forecast of Transit Freight Movement per annum

	Measurement	2008	2015	2030
Road Truck	Lorry Equivalents	213,631	274,244	499,370
Rail	Lorry Equivalents	302,939	429,292	916,731
River Boat	Lorry Equivalents	5,130	6,732	6,732

Source: Bulgaria Transport Model

This analysis clearly demonstrates the significant increase in freight transport demand linked to predicted strong growth in Bulgaria's economy.

5 Problem Identification

5 Problem Identification

5.1 Introduction

Before identifying options which could be included in the GTMP we first need to identify and understand the problems that exist now and which are likely to develop in the future if we do not make any changes to the way the transport system is managed and operated or to the infrastructure and services that are provided.

In reviewing the strengths and weaknesses of Bulgaria's transport systems we have considered three principal indicators:

- Capability - that is the features and qualities of the network and infrastructure and the way it is regulated, managed and operated;
- Capacity – that is the networks physical and operational structure and the volumes that can be accommodated, relative to demand; and
- Condition – that is the physical state of the infrastructure and its ability to provide a reliable and safe service.

The single biggest issue identified in relation to **capability** is the lack of continuous, contiguous and consistent networks to provide for the speedy and safe movement of longer distance traffic within, in to, out of and through Bulgaria. The prime example is the lack of motorway connectivity between major cities and border crossings.

Capacity is currently the least acute problem of the three. With the exception of the congested urban areas, which are outside the scope of the GTMP, the transport networks generally have sufficient capacity to accommodate the volumes of traffic that wish to use them. This position will change in the future with increasing demand.

If current trends continue the **condition** of much of the transport network asset will deteriorate. Additional demands placed on the networks and its associated supporting infrastructure will lead to an acceleration of the deterioration and result in a service to customers that becomes increasingly unreliable and ultimately unacceptable.

The process of examination of the strengths and weaknesses of Bulgaria's transport networks, services, regulation and control together with an identification and quantification of the current demands for transport of people and goods has allowed us to identify particular problems and gaps that need to be addressed.

The gaps can be defined as the shortfall between the demands that are put upon the system and the ability of the system to deliver to its users and customers an acceptable and appropriate level of service and safety and which will support broader economic and social aspirations for Bulgaria. It is these gaps that the Transport Master Plan must address through its development of options. This gap analysis does not aim either to provide any sort of scale or importance to the identified gap or to suggest any priority on how and when the gap should be overcome. This was developed in later stages of the project.

For simplicity the gap analysis is presented in the form of summary tables which, for each mode of transport, identifies gaps that have been identified separately for the management and regulation of the system and the infrastructure provided.

A unique reference number is provided for each gap which is carried through in to the option identification stage to allow individual options to be referenced against those gaps they have the potential to address.

5.2 Current Weaknesses and Gaps

5.2.1 Highways (Car and Coach)

No.	Highway Management and Regulation
HM 1	Insufficient funds for current and planned construction, repairs and maintenance of the road infrastructure
HM 2	Excessively long time interval between the preparation of projects and their implementation
HM 3	Lack of modern methods, processes and technologies for road maintenance
HM 4	Lack of systems for maintenance of highway links, intersections and structures
HM 5	Lack of contribution from research institutes, resulting in slow scientific and technical progress and the development and the implementation of new technologies
HM 6	Lack of incentives for employment of trained and qualified highway planners and engineers
HM 7	Outdated equipment, vehicles and machinery for the construction and maintenance of the highway
HM 8	Lack of integrated traffic organisation and intelligent transport systems. No national or local radio automatic traffic reports
HM 9	Little clarity or logic in the hierarchy of roads
HM 10	High number of incidents causing disruption as a result of unsatisfactory state of the road infrastructure
HM 11	Lack of specialised trucks necessary for container and intermodal transport

No.	Highway Infrastructure
HI 1	Incomplete basic motorway network to provide high quality, high speed connections between Bulgaria and neighbouring countries and between major centres of population within Bulgaria
HI 2	Unsatisfactory state of the road infrastructure not meeting appropriate conditions for continuous, convenient and safe transport
HI 3	Extremely poor condition of the road pavement on the Class 3 road network, the greatest part of which has not been repaired over 20 years. These roads are of importance for the municipalities and the links between different regions
HI 4	Numerous road sections with traffic levels close to the capacity of the road
HI 5	Shoulders on roads of class I, II and III that are not maintained
HI 6	Numerous bridges need immediate repairs or rehabilitation
HI 7	Inconsistency of geometric and other design standards on road sections
HI 8	Very high accident rates
HI 9	Lack of bypasses in many cities and settlements, especially where heavy traffic passes through. As a consequence, transit traffic goes through these dense populated areas.
HI 10	Poor or missing road markings on many sections of road, insufficient and inadequate traffic signs and no traffic condition variable message signing
HI 11	Bad condition of culverts and drainage on roads resulting in regular flooding
HI 12	Absence of sufficient road service areas
HI 13	Load capacities on the main international transport corridors that do not conform with the European standard of 11.5 t/axle

5.2.2 *Rail*

No.	Rail Management and Regulation
RM 1	Insufficient funds for current and planned construction, repairs and maintenance of the railway network and ancillary facilities for passengers and freight service operation
RM 2	No up to date and comprehensive asset inventory and condition survey
RM 3	High age profile of the workforce. Too few young and qualified people joining the railways
RM 4	Lack of experience in the provision of high quality services
RM 5	Poor maintenance of the network due to insufficient physical resources
RM 6	Year by year financing does not allow medium or long term planning of repair, replacement and ongoing maintenance.
RM 7	Poor customer information and a lack of basic timetable information
RM 8	No modern management information system to assist management in the execution of duties
RM 9	Lack of modern train control systems reducing capacity both in terms of system reliability and in relation to the smaller throughput of train services that old systems are able to manage
RM 10	Lack of plans to recover quickly from service disruption and delay. This includes provision of diversionary routes, staff familiarisation with back-up plans, and overall response to events
RM 11	Routes and service stopping patterns that do not reflect market requirements and the wider provision of public transport.
RM 12	Poor service frequencies on the country's key inter-city routes
RM 13	The number of trains crossing international borders is very low
RM 14	Poor availability of appropriate rolling stock (locomotives / wagons / coaches) affecting capacity
RM 15	Up to 75% of the network is subject to speed restrictions or other operational limitations
RM 16	Lack of market approach and experience of working in a competitive transport environment

No.	Rail Infrastructure
RI 1	Decline in services resulting from old trains, and life-expired infrastructure
RI 2	Network, rolling stock and traction power is often in a condition which is not fit for purpose
RI 3	Poor condition of infrastructure
RI 4	Reduced capacity due to the need to ensure safety in the areas of network in poor condition
RI 5	Permanent and temporary speed restrictions, potentially significantly impacting on capacity
RI 6	All lines crossing the borders are single track and the majority are non-electrified, resulting in a significant constraint on the capability of Bulgaria's international network
RI 7	Regular occurrence of catenary defects and signal and control system failures
RI 8	Regular basic permanent way infrastructure failures include damaged sleepers, deterioration in rail ends, loss of track formation and poor surface drainage
RI 9	Corrosion on steel railway bridges
RI 10	Serious fault cracks identified in a variety of concrete structures including retaining walls
RI 11	Poor condition of tunnel linings and track drainage
RI 12	The majority of the signalling used on Bulgarian railways is now rapidly becoming life expired
RI 13	A significant volume of freight reception lines, sidings, crane and haulage equipment, platforms and passenger facilities have been observed to be in poor condition
RI 14	Telecommunications are a mixture of digital and electromechanical systems and are becoming life expired
RI 15	Large part of the network is not used effectively resulting in raised costs for maintenance

5.2.3 Sea Ports and Waterways

No.	Sea Port Management and Regulation
SPM 1	Lack of sufficient investment into the maintenance and upgrading of port infrastructure
SPM 2	Shortage of modern port logistic and information systems
SPM 3	Security measures at the ports are not well developed. There is a need to upgrade security of vessels and ports and safety of ports through improved control of freight and passengers
SPM 4	Pollution prevention and control facilities, including collection and treatment of waste from ships and from port operations, are inadequate and require further upgrading
SPM 5	The industry has shown limited adaptability to changes in market demand and as a result Bulgaria has not kept pace with European maritime trade growth
SPM 6	Insufficient rate of development of private/public partnerships
SPM 7	Lack of investment interest on the part of strategic investors
SPM 8	Decrease in share of bulk cargoes when compared to neighbouring countries
SPM 9	Cargo handling rates are generally slow by modern standards
SPM 10	Vessel wait times and service times are excessive resulting in vessel delay costs potentially making the Ports uncompetitive compared to those in neighbouring countries
SPM 11	Incomplete vessel traffic management system. Lack of real-time information system about navigational risks.
SPM 12	Lack of electronic data interchange (EDI) system for registering ship arrivals/departures in ports
SPM 13	Lack of operational certification of port facilities, and lack of regularity of certificate updating

No.	Sea Port Infrastructure
SPI 1	Outdated cargo handling equipment and poor condition of berths
SPI 2	The existing berth structures are mainly of gravity block construction, making it difficult to deepen alongside for larger vessels
SPI 3	Draft limitations apply at a number of ports/terminals, restricting the draft/size of vessels calling and cargo exchange. Air draft limitations apply at Varna West and Varna Lake. (Asparuhov Bridge)
SPI 4	There has been insufficient investment in specialised terminals to provide adequate throughput capacity, and cost-effective and competitive performance
SPI 5	Intermodal terminals connecting the ports to the railway network are largely under-developed. Intermodal operators are poorly equipped with intermodal railway wagons. There are very few direct operational/logistic intermodal connections. Most containers at Varna are not transported as container transport further inland. There is limited flow of road transit containers and containers on rail
SPI 6	Some ports and terminals are located within urban areas, creating constraints to both port development and urban development, including adverse environmental impacts
SPI 7	The Bosporus Straits restrict the size and frequency of transits
SPI 8	The main power supply to the Port of Burgas is inadequate for the demands placed upon it and requires replacement
SPI 9	Internal rail yards at the Port of Burgas are in very poor condition resulting in low speeds and limited wagon movements
SPI 10	Inefficient usage of storage areas

No.	Inland Waterways Management and regulations
IWM 1	Historic lack of sufficient investment into the maintenance and upgrading of port infrastructure
IWM 2	Shortage of modern port logistic and information systems
IWM 3	Security measures at the ports are not well developed. There is a need to upgrade security of vessels and ports and safety of ports through improved control of freight and passengers
IWM 4	Pollution prevention and control facilities require further upgrading, including organisation and equipment for protection of environment at ports including collection and treatment of waste from ships and from port operations
IWM 5	Lack of real time information system providing information on navigation risks including ice drift, storms, fog, quick change in water levels and channel condition, obstacles including wrecks
IWM 6	Loss of attractiveness of the river as a key transport corridor
IWM 7	Under-developed pollution control facilities present unacceptable environmental risks
IWM 8	Insufficient development of private/public partnerships
IWM 9	Lack of investment in new infrastructure and port technologies
IWM 10	Lack of resources for maintenance
IWM 11	Lack of operational certification of port facilities, and lack of regularity of certificate updating

No.	Inland Waterways Infrastructure
IWI 1	Outdated cargo handling equipment, poor condition of berths and limited adaptability to market demand
IWI 2	There has been insufficient investment in specialised terminals to provide adequate throughput capacity, and cost-effective and competitive performance
IWI 3	Out-dated navigation security technologies
IWI 4	Two sections of the Danube navigation channel are non-compliant with the international standards set by Danube Commission in terms of depth
IWI 5	River guiding walls, groins and bottom sills in unsatisfactory state, which are partially or completely destroyed
IWI 6	Hazards to navigation, limited total channel availability to EU standard, resultant restricted vessel draft, restricted carrying capacity of river fleet
IWI 7	Under-developed intermodal connection between the ports and the railway network limit the potential for trade growth including transit trades
IWI 8	Lack of warning of river state to vessels

5.2.4 *Airports*

No.	Airports Management and regulations
AM 1	High degree of control of airport charges by the Council of Ministers both in terms of the way that the charges are currently structured and the level of charges that are set resulting in inability of Bulgarian airports to quickly respond to changing conditions in what is a dynamic and fast moving industry
AM 2	Unsatisfactory asset efficiency and financial performance at airports with highly seasonal traffic patterns (Plovdiv, Varna and Burgas airports)
AM 3	Lack of clarity on the roles and responsibilities of Border Police (Ministry of the Interior), Gendarmerie and airport operators, which are responsible for maintaining security at Bulgarian airports, particularly at the concessioned airports at Varna and Burgas. This multi-party arrangement is currently leading to ill-defined responsibilities and boundaries as well as

No.	Airports Management and regulations
	confusion and disagreement over the funding of the day-to-day security operation
AM 4	Poor quality of service for passengers at peak times during the busy seasons at Varna, Burgas and Plovdiv airports
AM 5	Poor quality of service at Plovdiv airport

No.	Airports Infrastructure
AI 1	Poor condition of the terminal buildings at Gorna Oryahovitsa, Turgovishte, Stara Zagora and Ruse airports
AI 2	Poor condition of the airfield assets at Gorna Oryahovitsa and Ruse, though the assets at Gorna Oryahovitsa airport are in better condition than those at Ruse airport. Poor condition of airport assets at the Turgovishte and Stara Zagora airports as well
AI 3	Overcrowding and poor passenger service levels as well as aircraft apron congestion during the busy summer peak at Burgas and Varna airports. The summer apron congestion problems have resulted in the loss of some cargo services because of the airport's inability to accommodate the cargo aircraft at peak times
AI 4	Lack of capacity at Plovdiv airport during the busy winter peak resulting in overcrowding and poor passenger service levels
AI 5	As a number of Bulgarian airports currently suffer from highly seasonal traffic patterns, for a large part of the year the airport assets are very poorly utilised

5.2.5 *Intermodal*

No.	Intermodal Management and Regulation
IMM 1	Lack of public transport service reliability means the chance of passengers missing connecting bus, rail or air services is high
IMM 2	Poor customer information and a lack of basic timetable and ticketing information for through public transport passenger services
IMM 3	Inadequate management information system to assist in the efficient operation of intermodal operations
IMM 4	Shortage of modern international port logistics and information systems
IMM 5	Insufficient use of public-private partnerships to optimize the cost of investment and increase the quality of operation of intermodal terminals

No.	Intermodal Infrastructure
IMI 1	Poorly maintained rail and bus stations with very limited passenger facilities making it unattractive to change trains or wait for buses
IMI 2	There is a lack of a national network of modern Intermodal terminals, serving the needs of rail and water freight
IMI 3	Intermodal operators are poorly equipped with intermodal railway wagons. There are very few direct operational/logistic intermodal connections
IMI 4	Under-developed intermodal connection between the ports and the railway network limit the potential for trade growth including transit trades
IMI 5	Internal rail yards at ports are in very poor condition resulting in low speeds and limited wagon movements
IMI 6	There are restricted and inadequate landside storage areas in many freight terminals

5.3 Future Weaknesses and Gaps to be Overcome

5.3.1 *Approach*

Section 5.2 above summarises the current strengths and weaknesses in transport management, systems, services and infrastructure and identifies gaps that exist between the demands that are put upon the system and what the system can currently deliver.

The analysis of future transport demand reported in Chapter 4 shows that as a result of the continuing fast pace of economic development in Bulgaria driving up personal incomes, vehicle ownership and mobility, the period from 2008 to 2030 will see a continued strong increase in travel demand for movements of people and materials within, in to, out of and transiting through Bulgaria.

We need to consider whether the predictions of changing future transport demand are likely to materially affect the conclusions reached for the existing situation.

5.3.2 *Road*

The gaps between the demands that are placed on the road network and the ability of the system to deliver to its users and customers an appropriate and acceptable level of service relate to:

- management and regulation;
- procurement and finance;
- environment;
- information;
- network hierarchy;
- network standard;
- maintenance; and
- safety.

The growth in demand up to 2030 is significant but is unlikely to add to the list of gaps presented in Section 5.2.1. Nevertheless each problem is likely to become more acute.

5.3.3 *Rail*

The current gaps between the demands that are put on the rail network and its associated infrastructure, signals and communication systems relate to:

- declining quality, frequency and speed of passenger services;
- ageing locomotives and rolling stock
- a network with redundant infrastructure;
- management and regulation;
- finance;
- an ageing workforce;
- information;
- maintenance; and
- safety.

As a result of a forecast decline in population and an increase in car ownership and personal income, without any changes to rail passenger services, speed or quality, there is predicted to be a small decline in the demand for passenger travel by rail up to 2030. In contrast there is forecast to be a significant increase in freight carried by rail. Overall it is considered that there are unlikely to be any additional gaps compared to those identified for the current situation but as with roads there is the potential for each problem to become more acute.

5.3.4 *Water*

The existing gaps between the demands that are put on the maritime and river shipping systems and its associated infrastructure relate to:

- Outdated equipment;
- maintenance;
- procurement and financing;
- management and regulation;
- adaptation to changing markets;
- intermodal facilities;
- information and security systems; and
- lack of effective competition.

Growth in demand for water borne transport is much harder to predict than for road and rail because of the greater uncertainties about the world economy and difficulty in forecasting the decline or growth in producers and products. If Bulgaria is to be able to effectively serve the needs of a more affluent population and a growing economy it must address the fundamental gaps irrespective of future uncertainties.

5.3.5 *Air*

The air passenger and air freight markets are at a very low level in Bulgaria compared to other European countries but have shown recent high levels of growth linked to entry in to Europe and the business this has generated and the tourism industry. The current gaps that have been identified are less severe than for other modes and potentially easier to address.

The key issues of inflexibility in control of air charges, the inefficiencies of highly seasonal markets, the absence of an international airport in the centre of the country and the long term satisfying of demand at Sofia will remain as air traffic grows.

5.3.6 *Intermodal Transport*

The significant gaps that exist between the provision of intermodal transport facilities and both freight and passenger movements in the existing situation are well understood. The growth in economic activity and in passenger and freight demands make the requirement to promote intermodal transport as part of the General Transport Master Plan more important and have the potential to result in:

- Improving overall transport efficiency bringing down costs for operators and customers;
- Reducing the rate of growth in car and truck traffic by providing incentives to use rail and water; and
- Supporting Bulgarian and European objectives for transport sustainability and ecological.

6 Option Identification

6 Option Identification

6.1 Introduction

The completion of the review of existing transport systems, future transport demand and the identification of a comprehensive list of weaknesses to be overcome provided us with the basis to prepare a comprehensive list of potential projects and interventions.

In this chapter we provide a summary of the process of identification of potential options to overcome the existing and future gaps in transport provision.

The starting point is the projects listed in the Operational Programme on Transport. However it has also been necessary to consider additional projects that have been suggested by stakeholders, to ensure that the aspirations of all relevant organisations are fully considered.

In developing the list of options, a broad range of potential solutions have been considered, including:

- Infrastructure investment;
- Service development;
- Intelligent transport solutions;
- Charging and fiscal mechanisms; and
- Other policy measures.

This chapter presents the following:

- the methodology adopted for identification and selection of options, including;
  - A description of the different types of intervention that are considered,
  - A discussion of the criteria for acceptance of an intervention in to the long list of potential options,
  - The various sources from which the option list has been generated,
  - A consistent approach to the provision of information to describe the particular intervention at the early stage of option identification,
- The long list of options identified as related to the primary modes and intermodal options. The lists are presented as summary tables with accompanying plans.

The appearance of an option at this stage does not suggest any more than that the intervention was considered to have the potential to form part of the ultimate plan.

Different terms are used to describe a proposal which may ultimately be included in the General Transport Master Plan; these include option, intervention and scheme. They should all be treated as the same and of equal standing.

6.2 Methodology for Option Selection

6.2.1 Overview

At the option identification stage of the project the objective was to identify all options and interventions that have the potential to significantly improve transport provision by any mode or combination of modes so as to effectively contribute to the economic and social development of Bulgaria.

6.2.2 Definition of an Intervention

There are a range of options and interventions that have the potential to positively contribute to transport development. While many will relate to the construction of new infrastructure others will be concerned with rationalisation or rehabilitation of existing infrastructure and more still will be concerned with the management and operation of the system.

The options can be broadly classified under three principal headings under which fall a number of more specific types of intervention:

- Management and Administration:
  - National, regional and municipal organisation of transport services
  - Regulation and control mechanisms
  - Organisational management and exploitation of human resource

  - Training and education
  - Funding routes
  - Revenue generation
  - Infrastructure charges
  - Subsidies
- Corridor Strategies (primarily new, enhanced and rehabilitated Infrastructure):
  - New Construction
  - New Equipment
  - Enhancement
  - Reconstruction
  - Rehabilitation
  - Rationalisation
  - Decommissioning
  - Closure
- Network Strategies (operations and services):
  - Service provision
  - Maintenance
  - Intelligent transport systems
  - Information
  - Education

6.2.3 *Sources of Information*

The list of options was drawn up by the projects key experts covering roads, railways, water transport and air transport. Supporting information was gathered from three primary sources:

- Review of published and un-published documents from agencies within Bulgaria and from European and other international groups.
- Discussions and consultation with officials and representatives of Government, transport providers and operators and other key stakeholders.
- Site visits and technical investigations by the key experts to understand firsthand the problems to be overcome. In this case the key experts used their international experience to identify options not referred to in either published sources or through consultation.

Four Government documents form the basis of the published information on transport options under consideration:

- Ministry of Transport – Sectoral Operational Programme on Transport (2007-2013) (OPT)
- Council of Ministers – National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan (2006-2015) (NS)
- Ministry of Transport – Analysis for the condition and perspectives for development of the road infrastructure in the Republic of Bulgaria
- Ministry of Transport - National Programme for Development of Public Transport Ports (2006-2015) (NPDPTP)

Projects in the OPT are referenced in the long list of options presented for each of the principal transport modes in sections 6.3 to 6.7.

Main transport priorities within the NS for each mode are shown in **Table 6.1**.

Table 6.1 – Transport Priorities in the National Strategy

Highways
Completion of motorways in the Republic of Bulgaria including the priority to develop the national road infrastructure.
Reconstruction and rehabilitation of road sections along TEN-T corridors including the objective to develop and modernise the road infrastructure and to adjust it to the European norms and standards.
Ensuring improved and more homogeneous transport operations, reconstruction and rehabilitation. This priority covers the objective to develop and improve the road infrastructure and to adjust it to the European norms and standards.

Railways
To build and develop the key transport infrastructure connections of national, cross-border and European importance and to improve the interoperability of the main railway lines with the trans-European railway system, as well as to connect the main railway system of the Republic of Bulgaria to that of neighbouring countries.
Development of the infrastructure needed for intermodal transport including the modernisation of the existing infrastructure, the optimisation of the capacity and efficiency of the existing and new infrastructure with a view to promoting intermodality.
Ports
Updating of the master plans for the development of ports and their adjustment to the requirements of the reform process covering the objective to modernise the infrastructure of the river Danube and sea waterways.
Development of the main port infrastructure and creation of conditions for better utilisation of the existing port infrastructure including the objective to modernise the infrastructure of the river Danube and sea waterway.
Creation of conditions for specialisation of port terminals. This priority covers the objective to modernise the port infrastructure, to improve navigation conditions and to promote the development of intermodal transport.
Enhancement of the efficiency of port operations including the objective to improve navigation conditions.
Creation of conditions for adjustment of Bulgarian ports to the EU requirements in the field of the protection of the environment.
Enhancement of the safety and security level of ports.
Airports
Improvement of the airport infrastructure on a short term basis.
Updating and preparation of master plans for the development of airports.
Enhancement of the safety and security level of airports.
Creation of conditions for adjustment of Bulgarian airports to the EU requirements in the field of the protection of the environment.

Source: National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan (2006-2015)

Listed below are the other principal agencies that have provided information:

- National Rail Infrastructure Company
- Agency for Roads Infrastructure (previously the National Road Infrastructure Fund)
- Rail Passenger Operators
- Rail Freight Operators
- Port and Maritime Administration Agencies
- Agency for Exploration and Maintenance of the Danube River
- Port Infrastructure Companies
- Port Operating Companies
- Port Operators
- Freight Forwarders
- Airport Operators
- Civil Aviation Authority

6.2.4 *Criteria for Inclusion in the Long List of Options*

In the process of bringing together the long list of potential options there has already been some selection at a very high level. This is to ensure that any intervention to be considered further meets at least a minimum set of criteria of acceptability in the context of the GTMP.

In addition to compliance with overarching economic, social, environmental and transport specific policies of the Bulgarian Government and of the European Union, options for potential inclusion in the GTMP need to satisfy other more specific tests. In particular, in the context of the GTMP being a strategic plan, these

relate to the scope and function of the intervention. The plan is not concerned with interventions within the cities. Its primary concern is with policies and strategies, and with trips that are:

- Between cities and major towns in Bulgaria;
- Between Bulgaria and neighbouring countries; and
- Crossing through Bulgaria connecting countries within Europe.

For acceptance of a scheme for European funding, an option or an intervention needs to meet the priorities, objectives and goals set up by the regulations of:

- the Trans-European Network;
- the European Priority Projects
- the Cohesion Fund; and
- the European Regional Development Fund.

However potentially significant interventions which would not be eligible for EU funding have also been included.

6.2.5 *Details included in the Option Lists*

At this stage of development of the Master Plan we did not require full details of an intervention. Sufficient detail is required in the way of description to allow a clear understanding of what the option comprises, where it is (if appropriate) and what its impacts are likely to be in general and broad terms.

The following sections introduce the options that were considered for each primary mode of transport and for combined modes. The information presented is as described below:

- Reference number – each option has a unique reference number.
- Name – the formal title if an existing scheme or a name for referencing purposes.
- Description – a brief description of the proposal and any critical information, in the case of an infrastructure scheme this includes the location, length, standard etc. A fuller description of each option is provided in Chapter 8.
- The intervention type – this is related back to the principal categories and the specific type within the category as defined in section 6.2.2 above.
- TEN-T – where appropriate the Trans-European Network corridor reference number along which the scheme lies and the EU Priority Project – where appropriate the project reference number.
- Programme – identification of any agreed programme within which an option is proposed for delivery, for example the Sectoral Operational Programme for Transport.
- Cost – where a cost estimate had already been prepared.
- Those gaps that the option has the potential to address, using the gap reference numbers from section 5.2.

In the presentation of the long list of options no attempt was made to make any sort of judgement on an intervention in respect of:

- Value for money;
- Ability to achieve funding;
- Success in achieving objectives;
- Environmental impact; or
- Priority and programme.

6.3 Highway Options

Table 6.2 provides the long list of options with descriptive details. Where an option relates to infrastructure works this is shown in **Figure 6.1**. Where an option involves a particular highway standard this is explained in the note at the foot of Table 6.2.

There are two highway schemes currently under construction that will be complete and operational by the first forecast year of 2015:

- Vidin – Calafat Bridge
- Lyulin Highway

These schemes are not included in Table 6.2.

There are seven highway schemes included in the Operational Programme for Transport (2007-2013):

- **A1 Trakia Motorway** – 115 km of new motorway from Stara Zagora to Karnobat to connect the existing sections of A1 and provide a continuous motorway from Sofia to Burgas. Completion of the motorway is particularly important to support the prosperity and future development of the Black Sea ports. Estimated cost is €350 m (€280 m from EU Cohesion Fund and €70 m from Sate Funds).
- **A6 Struma Motorway** – 77 km of new motorway in three lots. The estimated project cost is €250 m (€200 m from the EU Cohesion Fund and €50 m from Sate Funds).
  - Lot 1: Dolna Dikanya - Dupnitsa (17 km).
  - Lot 2: Dupnitsa - Simitli (45 km).
  - Lot 4: Sandanski - Kulata (15 km).
- **I-5 Kardjali-Podkova** - Rehabilitation of 12 km of existing highway and 16.5 km of new construction in two new sections from Kardjali to Djebel and from Djebel to Podkova. The estimated project cost is €32 m (€25.6 m from the EU Cohesion Fund and €6.4 m from Sate Funds).
- **A2 Connection of the Hemus Motorway to the Sofia Ring Road** - The construction of the new 8.5 km motorway section will connect the existing section of motorway Hemus and the Ring Road of Sofia. The estimated project cost is €32 m (€25.6 m from the EU Cohesion Fund and €6.4 m from Sate Funds).
- **A3 Maritsa Motorway** - 67 km of new motorway, starting from the end of the already finished part at KM 5 and ending at the beginning of the motorway section Harmanli - Lyubimets at KM 72. The estimated project cost is €209 m (€167 m from the EU Cohesion Fund and €42 m from Sate Funds).
- **E79 – Vratsa to Botevgrad** – Upgrading of the existing two-lane road to a four-lane dual carriageway road with a length of 31.5 km between Mezdra and Botevgrad. The estimated project cost is €85 m (€65 m from the EU Cohesion Fund and €17 m from Sate Funds).
- **E79 – Vidin to Montana** - Construction of first-class two-lane road with a length of 20.5 km between Dimovo-Bela-Ruzhintsi. The estimated project cost is €32 m (€25.6 m from the EU Cohesion Fund and €6.4 m from Sate Funds).

These schemes are included in Table 6.2.

Table 6.2 – Long List of Highway Options

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
H01	Roads Infrastructure Administration & Network Hierarchy	Review of national, regional and municipal organisations	Administrative - organisational	N/A			HM 2, 4, 5, 6, 8 & 9
H02	Funding and charging	Review of options for infrastructure funding and revenue generation	Fiscal – funding, revenue & charges	N/A			HM 1 & 2
H03	Network Maintenance Plan	Develop a funded, prioritised and programmed plan	Operations - maintenance	N/A			HM 1, 3, 4, 5, 6, 7 & 10 HI 2, 3, 5, 6, 10, 11, & 13
H04	Network Asset Condition Monitoring	Establish a Highway Asset Condition Monitoring System	Operations - maintenance	N/A			HM 1, 3, 4, 5, 6, 7 & 10 HI 2, 3, 5, 6, 10, 11, & 13
H05	Road Safety	Development of information and education campaign	Operations - information and education	N/A			HM 10 HI 3, 8, 9, 10 &11
H06	Driver Information Systems	Feasibility study for a national driver information system	Operations – service provision, ITS and Information	N/A			HM 8

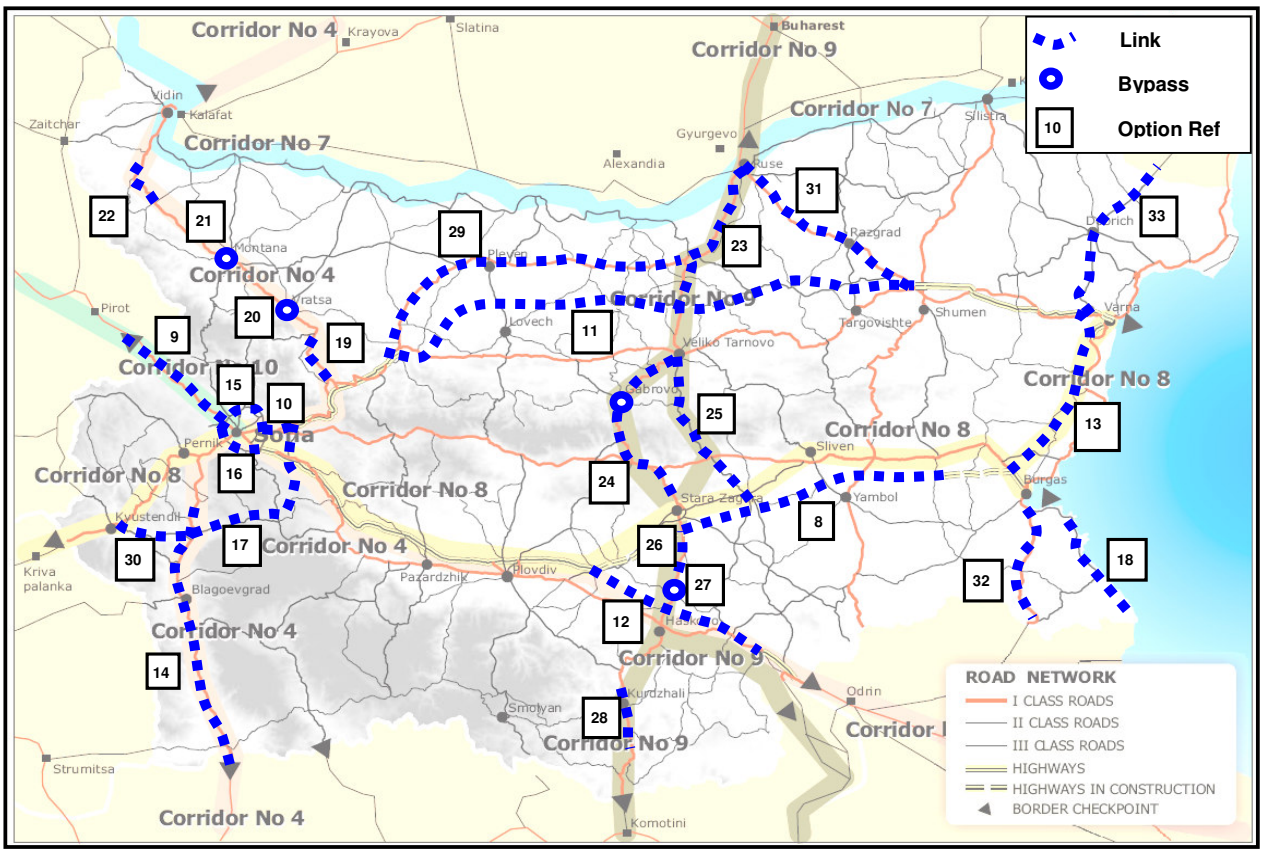
Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
H07	Training and Education	Review training and role of research institutes	Administrative – human resource	N/A			HM 5 & 6 HI 7 & 8
H08	A1 Motorway "Trakia"	Stara Zagora to Karnobat (115 km), D2M standard	Infrastructure - new construction	TEN-T VIII	OPT	350	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H09	A1 Motorway "Trakia"	Kalotina – Sofia Ring Road (47.7 km) D2M standard	Infrastructure – New construction	TEN-T X		215	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H10	A2 Motorway "Hemus"	Sofia Ring Road to Yana (8.5 km), D2M standard	Infrastructure - New construction	TEN-T IV	OPT	32	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H11	A2 Motorway "Hemus"	Yablanitsa to Shumen (230 km), D2M standard	Infrastructure - New construction	-		1186	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H12	A3 Motorway "Maritsa"	Chirpan to Harmanli (68 km), D2M standard	Infrastructure - New construction	TEN-T IV & IX	OPT	209	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H13	A4 Motorway "Black Sea"	Burgas to Priseltsi (95 km) D2M standard	Infrastructure - New construction	TEN-T VIII		400	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H14	A6 Motorway "Struma"	Dolna Dikanya to Kulata (138 km), D2M standard	Infrastructure - New construction	TEN-T IV EU PP 7	OPT	600	HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H15	Sofia Ring Road "Northern Arc"	Motorway Lyulin to Hemus (22.3 km). D2M standard	Infrastructure – New construction	TEN-T IV, VIII & X			HI 2, 4, 7, 8, 9, 10 & 13
H16	Sofia Ring Road "Southern Arc"	II-18, I-1, I-18 Motorway Lyulin to Motorway Trakia (28 km). D2AP standard	Infrastructure – construction, reconstruction, rehabilitation	TEN-T IV & VII			HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H17	Rila Highway	Dupnitsa to Motorway Hemus (89 km) D2AP standard	Infrastructure - New construction				HI 1, 2, 4, 7, 8, 9, 10, 11, 12 & 13
H18	Southern Black Sea Coast Road	II-99 and III-9901 Sozopol to Sinemorets D2AP/ S2AP	Infrastructure – construction, reconstruction, rehabilitation	-			HI 2, 4, 7, 8, 10 & 13
H19	Botevgrad to Mezdra	I-1/E79 Upgrade S2AP to D2AP (31.5 km)	Infrastructure – construction, reconstruction	TEN-T IV EU PP 7	OPT	85	HI 2, 4, 7, 8, 10 & 13
H20	Vratsa Bypass	I-1/E79 D2AP Standard	Infrastructure – New construction	TEN-T IV EU PP 7			HI 2, 4, 7, 9, 10 & 13
H21	Montana Bypass	I-1/E79 D2AP Standard	Infrastructure – New construction	TEN-T IV EU PP 7			HI 2, 4, 7, 9, 10 & 13

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
H22	Ruzhintsi to Dimovo	I-1/E79 improved alignment (20.5 km)	Infrastructure rehabilitation	TEN-T IV EU PP 7	OPT	32	HI 2, 4, 7, 9, 10 & 13
H23	Ruse to Motorway Hemus	I-5/E85 D2AP Standard	Infrastructure – construction	TEN-T IX			HI 2, 4, 7, 9, 10 & 13
H24	Veliko Tarnovo to Stara Zagora (Shipka)	I-5/E85 S2AP with climbing lanes, Shipka Tunnel and Gabrovo Bypass	Infrastructure – construction, rehabilitation	TEN-T IX			HI 2, 4, 7, 9, 10 & 13
H25	Veliko Tarnovo to Nova Zagora (Motorway Trakia)	II-55 S2AP with climbing lanes	Infrastructure – construction, rehabilitation	TEN-T IX			HI 2, 4, 7, 8, 10 & 13
H26	Stara Zagora to Dimotrovgrad	I-5/E85 S2AP standard	Infrastructure – construction	TEN-T IX			HI 2, 4, 7, 8, 9, 10 & 13
H27	Dimotrovgrad Bypass	I-5/E85 S2AP standard	Infrastructure – construction	TEN-T IX			HI 2, 4, 7, 9, 10 & 13
H28	Haskovo to Makaza (Greek Border)	I-5/E85 S2AP standard	Infrastructure – construction, rehabilitation	TEN-T IX	OPT	32	HI 2, 4, 7, 8, 10 & 13
H29	Yablanitsa to Byala	I-3/E83 S2AP with climbing lanes	Infrastructure – construction, rehabilitation	-			HI 2, 4, 7, 8, 10 & 13
H30	Kyustendil - Dupnitsa	II-62, S2AP with climbing lanes	Infrastructure – construction, rehabilitation	-			HI 2, 4, 7, 8, 9, 10 & 13
H31	Shumen to Ruse	I-2/E70 S2AP with climbing lanes	Infrastructure rehabilitation	-			HI 2, 4, 7, 8, 9, 10 & 13
H32	Burgas – Malko Tarnovo	I-9/E87, S2AP or D2AP standard dependent on traffic	Infrastructure rehabilitation	-			HI 2, 4, 7, 8, 9, 10 & 13
H33	Varna to Kardam via Dobrich	II-29 S2AP standard	Infrastructure rehabilitation	-			HI 2, 4, 7, 8, 9, 10 & 13

Highway Standards, Cross Sections and Design Flows

Standard	Category	Design Elements (dimensions in metres)			Design Flow (24hr AADT)
		Total Width	No of Lanes	Lane Width	
D3M (Dual Three Motorway)	Motorway	35.00	2 x 3	3.75 + 2 x 3.50	50000 - 80000
D2M (Dual Two Motorway)	Motorway	29.00	2 x 2	2 x 3.75	50000 - 70000
D2AP (Dual Two All-Purpose)	Class I	20.00	2 x 2	2 x 3.50	12000 - 30000
S2AP (Single Two All-Purpose)	Class I	12.00	2	2 x 3.75	5000 – 20000
S2AP (Single Two All-Purpose)	Class I & II	10.50	2	2 x 3.50	5000 - 20000

Figure 6.1 – Highway Scheme Options



6.4 Rail Options

Table 6.3 provides the long list of rail options with descriptive details. Where an option relates to infrastructure works this is shown in **Figure 6.2**.

There are two railway schemes currently under construction that will be complete and operational by the first forecast year of 2015:

- Vidin – Calafat Bridge
- Plovdiv to Svilengrad Railway Electrification and Modernisation. Completion of this scheme is covered by the Operational Programme.

These schemes are not included in Table 6.3.

There are five other railway schemes included in the Operational Programme for Transport (2007-2013):

- **Plovdiv to Burgas** - rehabilitation of railway infrastructure. The estimated project cost is €117 m (€94 m from the EU Cohesion Fund and €23 m from Sate Funds).
  - renewal of track on certain sections
  - repair of track and equipment on certain sections
  - renewal of signalling systems and telecommunications
- **Vidin to Sofia** – modernisation of the railway line including; construction works, signalling, telecommunications and information systems. The estimated project cost is €320 m (€256 m from the EU Cohesion Fund and €64 m from Sate Funds).
- **Sofia to Pernik to Radomir** – modernisation of the railway line to increase line speeds to 160 km/h. The estimated cost is €100 m (€80 m from the EU Cohesion Fund and €20 m from Sate Funds).
- **Sofia to Dragoman** - modernisation of the railway line. The estimated project cost is €59 m (€47 m from the EU Cohesion Fund and €12 m from Sate Funds).
- **Sofia to Plovdiv** - modernisation of the railway line including; construction works, signalling, telecommunications and information systems. The estimated project cost is €324 m (€259 m from the EU Cohesion Fund and €65 m from Sate Funds). In combination with the scheme between Plovdiv and Burgas this will ensure improved connections to and from the Black Sea Ports which will be vital to their prosperity, competitiveness and future development.

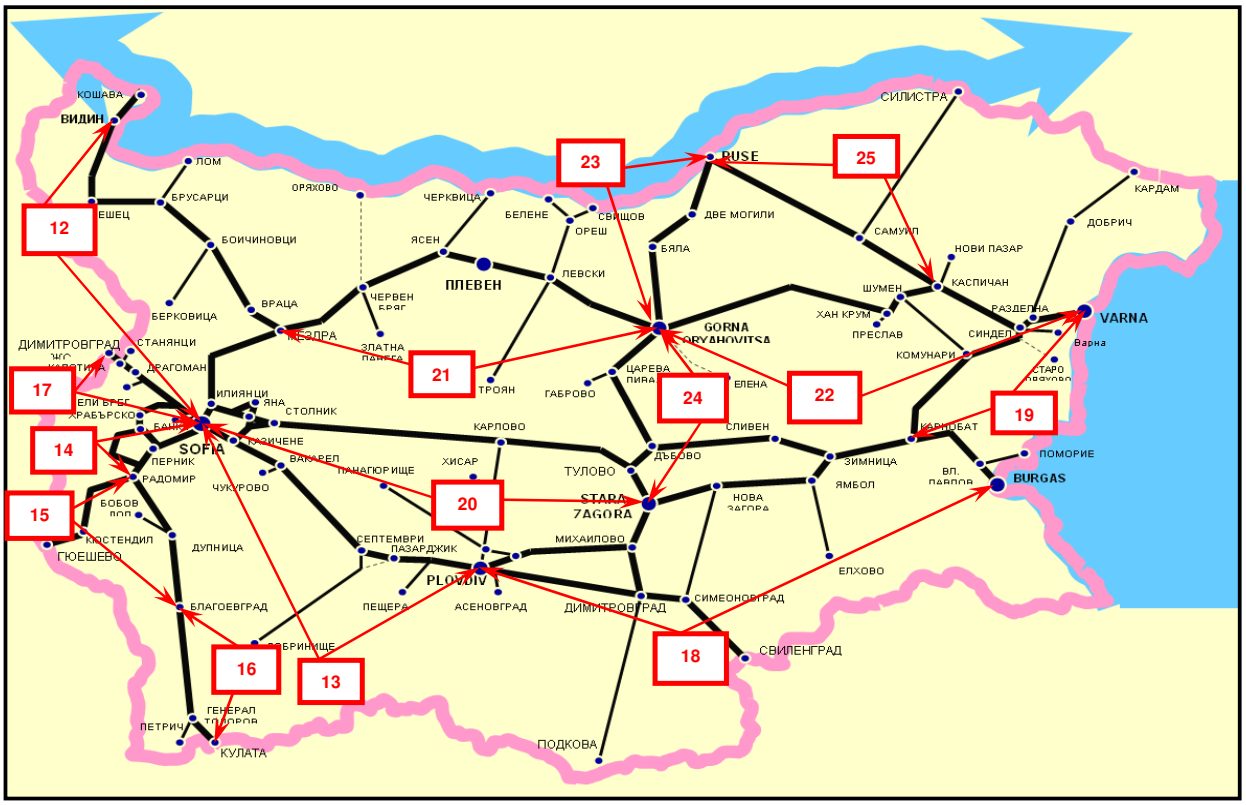
These schemes are included in Table 6.3.

Table 6.3 - Long List of Rail Options

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Program	Cost €mill	Gaps Addressed
R01	Railway Administration	Review of organisational structures	Administrative - organisational	N/A			RM 1, 4 & 7
R02	Funding and charging	Review of options for funding and revenue generation	Fiscal – funding revenue & charges	N/A			RM 1 & 4
R03	Network, Station & Facilities Rationalisation	Define network functionality and review infrastructure	Decommission and closure of Infrastructure	N/A			RI 3, 12, 14 & 15
R04	Freight Facilities Rationalisation	Review of existing facilities	Decommission and closure of Infrastructure	N/A			RI 3, 13 , 14 & 15
R05	Asset & Information Management	Management Information system and asset register	Organisational management	N/A			RM 2 & 8
R06	Network Maintenance Plan	Develop a funded, prioritised and programmed plan	Operations Maintenance	N/A			RM 5 RI 7, 8, 9, 10 & 11
R07	Speed Enhancements	Review opportunities for high speed services	Operations	N/A			RM 10, 11, 12 & 15, RI 1, & 12
R08	Passenger Facilities	Plan for upgrading of facilities at key stations	Infrastructure & Operations	N/A			RM 6 & 7 RI 14
R09	Passenger Information	Upgrading of information for passengers	Operations	N/A			RM 7
R10	Training and Education	Review training and the role of research institutes	Administrative	N/A			RM 3 & 4
R11	Locomotives & Rolling Stock	Review and plan for upgrades	Infrastructure & Operations	N/A			RM 10 & 14 RI 1 & 2
R12	Vidin to Sofia	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	IV EU PP 22	OPT	320	RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R13	Sofia to Plovdiv	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	IV & VIII	OPT	324	RM 8, 10, 11, 12 & 15, RI 1, 12 & 14
R14	Sofia – Pernik - Radomir	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	IV & VIII EU PP 22	OPT	100	RM 8, 10, 11, 12 & 15 RI 1, 12 & 14

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Program	Cost €mill	Gaps Addressed
R15	Radomir to Blagoevgrad	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	IV EU PP 22	OPT	4	RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R16	Blagoevgrad to Kulata (Greek border)	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	IV EU PP 22			RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R17	Sofia to Kalotina (Serbian border)	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	X	OPT	59	RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R18	Plovdiv - Stara Zagora - Yambol - Karnobat - Burgas	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	VIII	OPT	117	RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R19	Karnobat to Varna	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations	VIII			RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R20	Sofia – Karlovo - Stara Zagora	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R21	Mezdra to Gorna Oryahovitsa	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R22	Gorna Oryahovitsa to Varna	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R23	Gorna Oryahovitsa to Ruse	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R24	Gorna Oryahovitsa to Stara Zagora	Renew track infrastructure and systems, enhance operational performance	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14
R25	Ruse to Kaspichan	Infrastructure rehabilitation and enhancement of operations systems	Infrastructure & Operations				RM 8, 10, 11, 12 & 15 RI 1, 12 & 14

Figure 6.2 – Railway Scheme Options



6.5 Port and Waterway Options

Table 6.4 provides the long list of port and waterway options with descriptive details.

There are two port and waterway schemes that will be complete and operational by the first forecast year of 2015:

- Varna Lake - Container Terminal (400,000 TEU) listed in NPDPTP for implementation 2007-2011
- Burgas - Container Terminal (500,000 TEU) listed in NPDPTP for implementation 2007-2011

These schemes are not included in Table 6.4.

There are three port and waterway schemes included in the Operational Programme for Transport (2007-2013):

- **Vessel Traffic Management and Information System (Phase 3)** – being an Information and communication service for shipping. The project includes Infrastructure improvement, mounting TV and thermal imaging cameras and implementing satellite technologies for remote surveillance. The project will cover the whole Black Sea Coast and the Danube in real time. The estimated project cost is €4 m (€3 m from the EU Structural Fund and €1 m from Sate Funds).
- **Improvement of navigation on the Danube in joint Bulgarian - Romanian parts** – improvement of the navigation conditions in critical sections on the Danube to enhance shipping safety. The estimated project cost is €138 m (€117 m from the EU Cohesion Fund and €21 m from Sate Funds).
- **River Information Services System (RIS) on the Danube River -** construction and delivery of equipment for an RIS. The estimated project cost is €15 m (€13 m from the European Fund for Regional Development and €2 m from Sate Funds).

These schemes are included in Table 6.4.

The success of the Black Sea Ports will rely not only on the implementation of port and waterway options but will also be dependent on the delivery of improvements to road and rail connections which will transport those goods and materials being imported, exported and transiting through Bulgaria. When reviewing options to overcome the weaknesses and gaps which have been identified as relating to ports and waterways, consideration must also be given to benefits that can accrue from improvements to other modes of transport.

Table 6.4 – Long List of Port and Waterway Options

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
W00	Verification and estimation for exploitation ability	Introduction of quality control systems	Administrative – regulation and control				SPM 13 IWM 11
W01	Regulation - safety environment and operations	Compliance audits for vessels, ports and port operators	Administrative – regulation and control		OPT		SPM 3 & 4 IWM 3 & 4
W02	Port safety and security measures	Evaluation and upgrading to European standards	Operative – granting services		NPDPTP	8	SPM 3 IWM 3
W03	Reservation of land for port use	Review processes for reservation	Administrative				SPM 6 & 7 IWM 8 & 9 SPI 5, 6 & 10 IWI 2
W04	Management of port concession procedures	Changes in law, to streamline concession process	Administrative				SPM 1, 6 & 7 IWM 1, 8 & 9 SPI 4 & 5 IWI 3
W05	Port efficiency improvements	Evaluation of causes of slow service times; implementation of corrective measures	Operations – services Infrastructure - enhancement				SPM 9 & 10 IWM 6 SPI 1 IWI 1
W06	Terminal maintenance improvements	Changes in procedures for maintenance of terminals	Administrative Operations – maintenance				SPM 1, 9 & 10 IWM 1 SPI 1 IWI 1
W07	Terminal equipment procurement efficiencies	Changes in procedures for procurement of new terminal operating equipment	Administrative Infrastructure – equipment Operations – services				SPM 1, 9 & 10 IWM 1 SPI 1 IWI 1
W08	Receival of liquid and hard waste (Sea Ports)	Preparation of waste management plans	Operations – services	TEN-T VIII	NPDPTP	20	SPM 4 IWM 4 & 7
W09	National Ports Association	Establish association to promote port co-operation	Administrative				SPM 1-10 IWM 1-10
W10	Vessel Traffic Management and Information System	Information and communication service for shipping	Operations - systems		OPT	4	SPM 11
W11	Danube River Navigation	Improvement of navigation conditions to enhance safety	Infrastructure – construction/ improvements	TEN-T VII EU PP 18	OPT	138	IWM 6 IWI 6, 7 & 8
W12	Information System for Danube River	System design / Equipment delivery	Operative - systematic	TEN-T VII EU PP 18	OPT	15	MR 6, I5 & I 0
W12a	Receival of liquid and hard waste (Danube Ports)	Preparation of waste management plans	Operations – services	TEN-T VII EU PP 18	NPDPTP		IWM 7

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
W13	Danube River Winter Shelter	Shelter for 39 vessels	Infrastructure - construction	TEN-T VII	NS	13	IWM 9
W14	Port Varna	Review of master-plan and port development strategy	Technical research & forecast modelling	TEN-T VIII	NS NPDPTP		SPM 1, 2, 5, 6, 7, 8, 9 & 10 SPI 1, 2, 3, 4, 5, 6, 9 & 10
W15	Varna – Separations and Concessions	Separation of port in to 3 parts to stimulate competition and concessions	Administrative – organising transport services	TEN-T VIII	NPDPTP		SPM 1, 2, 6, 7, 9 & 10 SPI 1 & 4
W16	Varna West - Capacity Improvements	Channel deepening, berth rehabilitation and modernisation of equipment	Infrastructure – enhancement, rehabilitation & rationalization	TEN-T VIII			SPM 1, 9 & 10 SPI 1, 2, 3 & 4
W17	Varna West – Terminal for hazardous cargo	Construction of a 1.2mtpa hazardous cargoes terminal	Infrastructure – new construction	TEN-T VIII	NPDPTP	24	SPM 1,6, 7, 9 & 10 SPI 1, 3 & 4
W18	Access to the Varna Lake	Increasing allowable vessel air and channel draft	Infrastructure - modernisation	TEN-T VIII	NPDPTP		SPI 3
W19	Varna Lake – Grain Terminal	Construction of a 1mtpa terminal in Varna Lake	Infrastructure – new construction	TEN-T VIII	NS NPDPTP	16	SPM 1, 9 & 10 SPI 1, 4, 6 & 10
W20	Varna - Deep Water Berth	New deep water terminals to east of the bridge	Infrastructure – new construction	TEN-T VIII			SPI 2 & 3
W21	Varna East – Ro-Ro, ferry and passenger terminal	Construction of new terminal and business centre	Infrastructure – new construction	TEN-T VIII	NPDPTP	23	SPM 3, 5, 6 & 7 SPI 4
W22	Varna – Intermodal Terminal	Construction of a new terminal with capacity of 1.8mtpa	Infrastructure – new construction	TEN-T VIII			SPM 5 & 9 SPI 5, 9 & 10
W24	Varna West – Container Terminal	Expansion of the container terminal to 100,000TEU	Infrastructure construction & new equipment	TEN-T VIII	NS NPDPTP	7	SPM 1, 9 & 10 SPI 10
W24a	Varna Lake – Fuel Terminal	New bulk fuels terminal (2mtpa) in Konstantinovo	Infrastructure construction & new equipment	TEN-T VIII	NPDPTP		SPM 1, 9 & 10 SPI 1, 4, 6 & 10
W24b	Varna East – Logistics Centre	Additional option for W21	Infrastructure - construction	TEN-T VIII			SPM 3, 5, 6 & 7 SPI 4
W25	Lesport – Grain Terminal	Development of multifunctional terminal for grain and liquid cargos	Infrastructure – new construction	TEN-T VIII	NS	66	SPM 1, 9 & 10 SPI 1, 4, 6 & 10
W26	Port Burgas	Review of master-plan and port development strategy	Technical research & forecast modelling	TEN-T VIII	NS NPDPTP		SPM 1, 2, 5, 6, 7, 8, 9 & 10 SPI 1, 2, 3, 4, 5, 6, 8, 9 & 10

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
W27	Burgas – Separations and Concessions	Separation of port in to 4 parts to stimulate competition and concessions	Administrative – organising transport services	TEN-T VIII	NPDPTP		SPM 1, 2, 6, 7, 9 & 10 SMI 1 & 4
W28	Burgas – Terminal East	Moving bulk cargo and metals to T1, T2 and T3 because of the existing unsuitable location	Infrastructure – granting a public access	TEN-T VIII	NS		SPM 1, 5, 8, 9 & 10 SMI 1, 2, 3, 4, 6 & 10
W30	Burgas – Bulk Liquids Terminal (Terminal 1)	New terminal for oil, chemicals, alcohol, wine, distillates and general cargo	Infrastructure – new construction	TEN-T VIII			SPM 2, 5, 6, 7, 8, 9 & 10 SPI 1, 2, 3 & 4
W31	Burgas - General Cargo Terminal (Terminal 2B)	Terminal for cast iron ingots and general cargo (1.4 mtpa)	Infrastructure – new construction	TEN-T VIII			SPM 2, 5, 6, 7, 8, 9 & 10 SPI 1, 2, 3 & 4
W32	Burgas – Crude Oil Terminal	Expansion of Rosenets Liquid Cargo Facility (30-35 mtpa)	Infrastructure – new construction	TEN-T VIII			SPM 1, 6, 7, 9 & 10 SPI 1, 3 & 4
W33	Burgas – Rosenets Crude Oil Port	Expanding and reconstruction of the crude oil port	Infrastructure – modernisation and new construction	TEN-T VIII	NPDPTP	13	SPM 1,6, 7, 9 & 10 SPI 1, 3 & 4
W34	Burgas - Liquefied Natural Gas Terminal	Development of new terminal	Infrastructure – new construction	TEN-T VIII			SPM 1,6, 7, 9 & 10 SPI 1, 3 & 4
W35	Burgas – Rosenets Channel Dredging	Dragging of the approaching canal	Infrastructure – rehabilitation	TEN-T VIII	NPDPTP		SPI 3
W36	Burgas Terminal 3	New Ro-Ro and Ferry Terminal	Infrastructure –construction	TEN-T VIII			SPM 5, 6, 7, 9 &, 10 SPI 1 & 4
W37	Burgas – Passenger Terminal	New transport interchange, rail, bus and ferry	Infrastructure – new construction	TEN-T VIII	NPDPTP	15	SPM 3, 5, 6 & 7 SPI 4
W38	Burgas – Intermodal Terminal	Construction of a new terminal with capacity of 2.6mtpa	Infrastructure – new construction	TEN-T VIII			SPM 5 & 9 SPI 5, 9 & 10
W39	Burgas - Capacity Improvements	Rehabilitation of power supply	Infrastructure - rehabilitation	TEN-T VIII			SPM 1 SPI 8
W40	Burgas – Nesebar, Sozopol, Pomorie, Tsarevo, Ahtopol	Relocation of trade because of unsuitable locations	Infrastructure – optimisation	TEN-T VIII	NS		SPI 6 & 10
W41	Port Lom	Review of master-plan and port development strategy	Technical research & forecast modelling	TENT- VII EU PP 18	NS NPDPTP		IWM 1, 2, 6, 8, 9 & 10 IWI 1, 3, 4 & 9

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Programme	Cost €mill	Gaps Addressed
W42	Lom – Separations and Concessions	Separation of port in to 3 parts to stimulate competition and concessions	Administrative – organising transport services	TENT- VII EU PP 18	NPDPTP		IWM 1, 6, 8, 9 & 10 IWI 1, 4 & 8
W43	Lom – Multi-purpose Terminal	General Cargo (1 mtpa) and Container (100,000 TEU) terminals	Infrastructure – new construction	TENT- VII EU PP 18	NPDPTP	20	IWM 1, 6, 8 & 9 IWI 1 & 4
W44	Lom - Equipment Improvements	Modernisation of cranes and support structures	Infrastructure – equipment enhancement	TENT- VII EU PP 18			IWM 1 & 9 IWI 1
W45	Lom – Capacity Improvements	Rehabilitation of quay walls and port territory	Infrastructure - rehabilitation	TENT- VII EU PP 18			IWM 1 IWI 1
W46	Lom – Intermodal Terminal	Construction of a new terminal with capacity of 0.6 mtpa	Infrastructure – new construction	TENT- VII EU PP 18			IWM 6 IWI 3, 4 & 8
W47	Port Ruse	Review of master-plan and port development strategy	Technical research & forecast modelling	TEN-T VII, IX EU PP 18	NS NPDPTP		IWM 1, 2, 6, 8, 9 10 IWI 1, 3, 4 & 9
W48	Ruse – Separations and Concessions	Separation of port in to 6 parts to stimulate competition and concessions	Administrative – organising transport services	TEN-T VII, IX EU PP 18	NPDPTP		IWM 1, 6, 8, 9 & 10 IWI 1, 4 & 8
W49	Ruse – Grain Terminal	Phase 1: 40,000 mtpa Phase 2: 30,000 mtpa	Infrastructure – new construction	TEN-T VII, IX EU PP 18	NPDPTP	3	IWM 1, 6, 8 & 9 IWI 1 & 4
W50	Ruse - Capacity Improvements	Development of additional open storage areas	Infrastructure – new construction	TEN-T VII, IX EU PP 18			IWM 1 & 9 IWI 1
W51	Ruse - Equipment Improvements	Larger capacity cranes for Ruse, Somovit, Tutrakan	Infrastructure – new equipment	TEN-T VII, IX EU PP 18			IWM 1 & 9 IWI 1
W52	Ruse Centre – Passenger Terminal	Passenger Terminal (300,000 ppa) and recreation zone	Infrastructure – new construction	TEN-T VII, IX EU PP 18	NPDPTP	10	IWM 3, 6, 8 & 9 IWI 4
W53	Ruse – Intermodal Terminal	Construction of a new terminal with capacity of 1.2 mtpa	Infrastructure – new construction	TEN-T VII, IX EU PP 18			IWM 6 IWI 3, 4 & 8
W54	Silistra - Ro-Ro Terminal	New terminal (200,000 TEU)	Infrastructure – new construction	TEN-T VII EU PP 18	NPDPTP	6	IWM 6, 8 & 9 IWI 4

Notes: NS - National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan (2006-2015)
NPDPTP - Ministry of Transport - National Programme for Development of Public Transport Ports (2006-2015)

6.6 Air Transport Options

Table 6.5 provides the long list of port and waterway options with descriptive details.

There are no airport or air transport schemes included in the Operational Programme for Transport (2007-2013).

Table 6.5 – Long List of Air Transport Options

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Program	Cost €mill	Gaps Addressed
A01	Airport Charges	Change to allow greater flexibility	Regulation and Legislation				AM 1
A02	Air Market Study (North & Central Bulgaria)	Assessment of current/future potential	Technical Study			0.03	AI 1 & 2
A03	Security Operations	Redefine accountabilities and responsibilities	Organisation and Legislation				AM 3
A04	Gorna Oryahovitsa	Investment for international cargo/passenger operations	Infrastructure and Systems			30	AI 1 & 2
A05	Gorna Oryahovitsa	Airport full or part concession	Regulation and Management				AI 1 & 2
A07	Plovdiv	Airport concession	Regulation and Management				AM 2 & 4 AI 4 & 5
A08	Plovdiv, Varna & Burgas	Route development/ marketing study	Technical Study			0.06	AM 2 AI 2
A09	Sofia Airport	Capacity Development	Infrastructure			50	
A10	Turgovishte	Airport full or part concession	Regulation and Management				AI 1 & 2
A11	Stara Zagora	Airport full or part concession	Regulation and Management				AI 1 & 2
A12	Ruse Airport	Airport full or part concession	Regulation and Management				AI 1 & 2
A13	Ruse Airport	Investment for international cargo/passenger operations	Infrastructure			>50	AI 1 & 2
A14	Turgovishte Airport	Investment for international cargo/passenger/ general aviation operations	Infrastructure			>50	AI 1 & 2
A15	Stara Zagora Airport	Investment for international cargo/passenger/ general aviation operations.	Infrastructure			>50	AI 1 & 2

6.7 Inter-Modal Options

Table 6.6 provides the long list of intermodal options.

There are two intermodal schemes currently under construction that will be complete and operational by the first forecast year of 2015. These are the container terminals at Port Varna and Port Burgas, as described in section 6.5; they have not been included in the long list of options because they are committed schemes.

There is one intermodal scheme included in the Operational Programme for Transport (2007-2013):

- **Sofia Intermodal Terminal** – a new rail/road freight interchange and logistics facility to the east of the city and close to the international airport. The estimated project cost is €26 m (€22 m from the EU Cohesion Fund and €4 m from Sate Funds).

This scheme is in the final stages of preparation and therefore has not been included in Table 6.6.

Table 6.6 – Long List of Intermodal Options

Ref No.	Name	Description	Intervention Type	TEN-T EU Project	Program	Cost €mill	Gaps Addressed
IM01	Plovdiv Inter-Modal Terminal	New road/rail interchange	Infrastructure	IV & VIII			IMI 2
IM02	Ruse Inter-Modal Terminal	New road/rail interchange	Infrastructure	VII & IX			IMI 2
IM03	Public Transport Interchange	Review of requirements for upgrading transport interchanges in cities and major towns	Technical Study				IMM 1 IMI 1
IM04	Port/Rail Interchange	Review of requirements to upgrade water/rail transfer facilities at major ports	Technical Study				IMI 4, 5 & 6
IM05	Intermodal Rail Rolling Stock	Review of requirements for new inter-modal rolling stock	Technical Study				IMI 3

7 Appraisal Framework

7 Appraisal Framework

7.1 Introduction

The option identification stage of the project identified a total of 134 options and interventions which had the potential to make a positive contribution to the objectives set for the GTMP. However, no attempt had been made to determine the scale of contribution or whether they were affordable, deliverable and would complement or conflict with each other. To determine this there was a need to develop a framework and method for appraisal of options which met particular requirements to:

- support applications for funding from the EU's Cohesion and Structural Funds;
- identify which projects are suitable for procurement using public private partnership mechanisms;
- provide an assessment of projects funded through other possible routes; and
- assess the overall Transport Master Plan.

The framework developed built upon the prioritisation methodology used to develop the indicative list of projects included in the OPT and covers:

- Financial analysis;
- Social cost benefit analysis;
- Assessment of environmental impact (a strategic Environmental Assessment was required for the overall strategy);
- Safety impact assessment;
- Impact on accessibility to, from, through and within Bulgaria;
- Social and equity impact;
- Impact on the achievement of the wider objectives of the National Strategic Reference Framework including economic growth and sustainability; and
- Deliverability including the potential to obtain funding.

This brings together all the EU and national objectives with AECOM's view of the gaps in the transport provision in Bulgaria. The framework was designed to assess both individual modes and the linkages that exist between the different modes. This includes assessing the benefits and disbenefits for users of those modes and assessing the external impacts on non-users.

This chapter provides an overview of the appraisal framework adopted, including:

- A review of relevant existing guidance and frameworks;
- an overview of the general approach taken to appraisal;
- the main criteria which were considered to ensure that all aspects of beneficial and adverse impacts were considered; and
- the development of the framework and how it was applied.

7.2 Review of Guidance

The framework needs to be set in the context of the objectives of the Bulgarian Government and the regulatory framework of the EU. It also needs to highlight the role of appraisal in determining if the options being appraised contribute to meeting these objectives. The framework was designed to meet such scrutiny and is required to support decisions on alternative funding routes.

7.2.1 European Union Guidance and Objectives

Creating a competitive environment, which ultimately leads to economic efficiency and increased social welfare, is the underlying theme of the guidance produced by the European Commission. The EU focuses on:

- Interventions in the development of the Trans European Network;
- Regulation and competition among and between modes;
- Setting of prices that include charging and the external costs;
- Overcoming the disadvantage experienced by peripheral regions as targeted by the Cohesion Fund; and
- Overcoming relative economic deprivation through the European Regional Development Fund.

The main objectives of EU transport policy are defined in the 2001 White Paper – "European Transport Policy for 2010" and focus on shifting the balance between modes of transport to effectively manage available transport capacity and reduce highway congestion.

The main objectives from the 2001 White Paper, that needed to be included in the appraisal framework for the General Transport Master Plan, are:

- Creation of a trans-European transport network (TEN-T);
- Transfer of freight from roads to railways and maritime transport;
- Development of a modern public transport system with a view to reducing the use of private cars and CO_2 emissions; and
- Increase in the use of private capital in the implementation of transport development schemes.

In 2006, a review of the White Paper was undertaken and it was reported that future transport policy needs to build on the achievements of the earlier policies when responding to the challenges that have arisen since 2001. It was declared in the 2006 review that the EU transport systems have to:

- Offer a high level of mobility to people and businesses throughout the Union;
- Protect the environment, employment, the citizen and the passenger;
- Innovate in support of the first two aims of mobility and protection by increasing the efficiency and sustainability of the growing transport sector; and
- Connect internationally.

The European Commission is undertaking a number of studies that are to feed into the next White Paper expected in 2011. However the current White Paper (2001) is guiding current transport policy and appraisal. This appraisal was undertaken with regard to the principles contained within the 2001 White Paper.

7.2.2 The National Strategic Reference Framework 2007-2013

This document forms the primary policy basis for Bulgaria covering the short and medium term period from 2007 to 2013. The National Strategic Reference Framework for Bulgaria is a major source of the principles used in the appraisal.

The framework sets out the link between a well developed and high quality transport network and the continued development and growth of the Bulgarian economy focusing on the importance of international trade to a small economy, especially where trade is with its EU partners.

The impact of poor transport on internal economic activity is demonstrated in relation to the faster developing large urban areas on one hand and the isolated small settlements with a potential for growth on the other.

7.2.3 The National Strategy of the Integrated Development of the Infrastructure of Bulgaria and Action Plan for the Period 2006-2015

The National Strategy was published in May 2006. It identifies the requirements for the delivery of all infrastructure in the economy, not just transport, and hence provides the balanced view that is required when there is competition for financial resources within Bulgaria.

The framework demonstrates the desire of the Bulgarian Government is firstly to analyse and assess the condition of the existing transport infrastructure then to use this to identify the main priorities with respect its development, maintenance and modernisation. The final stage is to specify the most important infrastructure projects with supporting funding and implementation plans. The General Transport Master Plan is an output in the fulfilment of these initial requirements.

The National Strategy defines eight major overarching **objectives** for transport:

- Build and develop the key transport infrastructure connections of national, cross-border and European importance and to improve the interoperability of the main railway lines;
- Develop the national road infrastructure and to integrate it into that of the EU Member States;
- Develop and improve the road network and to adjust it to the European norms and standards;
- Optimise the capacity and efficiency of the existing and new infrastructure;
- Modernise the infrastructure of the river Danube and sea waterways;
- Improve the conditions for navigation and promotion of intermodal transport;
- Develop and modernise airports and to adjust them to the requirements of the European Union in the field of the protection of the environment; and

- Promote public-private partnerships.

The National Strategy also identifies eight main national **priorities** for transport:

- Effective maintenance and modernisation of the transport infrastructure;
- Transparent and harmonised conditions for competitiveness and liberalisation of the transport market;
- Integration of the Bulgarian transport system in to the EU transport system;
- Ensuring adequate financing for development and functioning of the transport sector;
- Limitation of the environmental and health impact of transport;
- Development of intermodal transport;
- Adequate, qualitative and quantitative satisfaction of the transport needs; and
- Sustainable development of the public transport system.

7.2.4 *International Best Practice – Appraisal Frameworks*

Appraisal frameworks are commonly developed to include both quantitative and qualitative appraisal, covering monetised and other assessment tools. Great progress has been made in recent years in placing money values on air quality and other environmental impacts. However, there are still areas of any appraisal structure that need to be measured in a qualitative way. The International Monetary Fund (IMF) and World Bank tend to focus on the economic and financial criteria, while in some countries comprehensive multi-criteria appraisal processes have been developed to improve the allocation of finite resources whilst considering the distributive effect to those in the lower income groups of society; consistency with land use policy and care for the environment being examples.

There have been a number of studies into appraisal frameworks in transport. One of the most recent is detailed in a report entitled "Harmonised European Approaches for Transport Costing and Project Assessment" (HEATCO) funded by the EU and produced in 2005. The study considered appraisal processes in eight countries in Eastern Europe.

The framework structure for the GTMP appraisal has been developed from the findings of HEATCO together with different approaches in existing appraisal frameworks including:

- Ireland's Common Appraisal Framework;
- The United Kingdom's (UK) New Approach to Appraisal;
- The Federal Transit Authority Approach in the United States; and
- The Public Sector Appraisal in Norway.

7.2.5 *International Best Practice – Cost Benefit Analysis (CBA)*

Most if not all appraisal frameworks depend heavily on financial and socio-economic cost benefit analyses. However in recent years the CBA monetary analysis has been expanded to include values for other attributes especially environmental ones and hence the financial and socio-economic analyses have reduced in their relative importance.

There are a number of guidance documents specific to the EU with two of these focused solely on the requirements of the transport sector in Bulgaria. These documents have all contributed to the detailed approach to generating financial and economic cost benefit analysis including the placing of monetary values on air pollution, climate change and time savings as well as the processes for calculating costs.

The documents reviewed and used in the GTMP process include:

- Guide to Cost Benefit Analysis of Investment Projects – Structural Funds, Cohesion Fund and Instrument for Pre Accession – Final Report/ 16th June 2008 (European Commission Directorate General Regional Policy);
- Guidance on the Methodology for Carrying Out Cost Benefit Analysis Working Document No 4 – August 2006 (European Commission Directorate General Regional Policy);
- Bulgaria – General Guidelines for Cost Benefit Analysis for Projects to be Supported by the Cohesion Fund and the European Regional Development Fund in 2007-2013 – Draft/October 2008 (Jaspers); and
- Requirements for Preparation of CBA in transport sector – Version 2/October 2008 (Produced by the Ministry of Finance, Ministry of Transport, National Company Railway Infrastructure, Metropolitan EAD, National Road Infrastructure Fund).

7.3 General Approach to Appraisal

7.3.1 *Role of the Appraisal Framework*

EU Regulations require the proposer of any project for funding to demonstrate that a comprehensive feasibility and option analysis has been undertaken against a forecast 'Do Minimum' scenario.

There are a wide range of different types of options from modernisation and rehabilitation of existing infrastructure to the building of new infrastructure, from service enhancement to new or modified administrative and regulatory processes.

The framework must be able to produce a coherent and reasoned choice between the different types of options covering a number of modes and with different outputs, outcomes and impacts.

The framework was designed to assist in determining:

- Which options best meet objectives set nationally, internationally and in the context of the Master Plan itself;
- Which options represent good value in financial, economic, social and environmental terms;
- Prioritisation relating to fundability, state of readiness and fit with other options; and
- The most appropriate funding route for each option including EU funding or Public Private Partnership (PPP) financing.

7.3.2 *Overview of the Approach*

The appraisal was undertaken using a four stage approach. These four stages comprised two preliminary stages, used for identifying and appraising options, and a further two Master Plan development stages that included a review of previously identified weaknesses and gaps to be overcome and the appraisal of the initial programme/Master Plan. These four stages are summarised and illustrated in **Figure 7.1**:

- Stage 1 – Initial Appraisal;
- Stage 2 – Detailed Appraisal;
- Stage 3 – Review of Gap Analysis; and
- Stage 4 – Initial Programme/Master Plan Analysis.

7.3.2.1 Stage 1 - Initial Appraisal

The initial appraisal was used to examine all the options identified and described in Chapter 6 at a high, strategic level. All important evaluation criteria were included and represented by individual objectives together with policies and targets from relevant European Union and Bulgarian Government documents.

The impact of each aspect of the option was assessed using a standard seven point rating from +3 (highly positive), through 0 (neutral) to -3 (highly negative).

The Stage 1 Appraisal was undertaken by the key experts in multi-criteria appraisal, cost benefit analysis and environmental assessment supported by the modal experts in the team.

This process allowed a rapid assessment of all the options in a consistent and objective manner and the rejection of options which performed poorly, or where an alternative clearly met the same objective more effectively. This enabled options to be excluded which had no likelihood of being included in the final strategy, while ensuring that there was necessary evidence to support the decision.

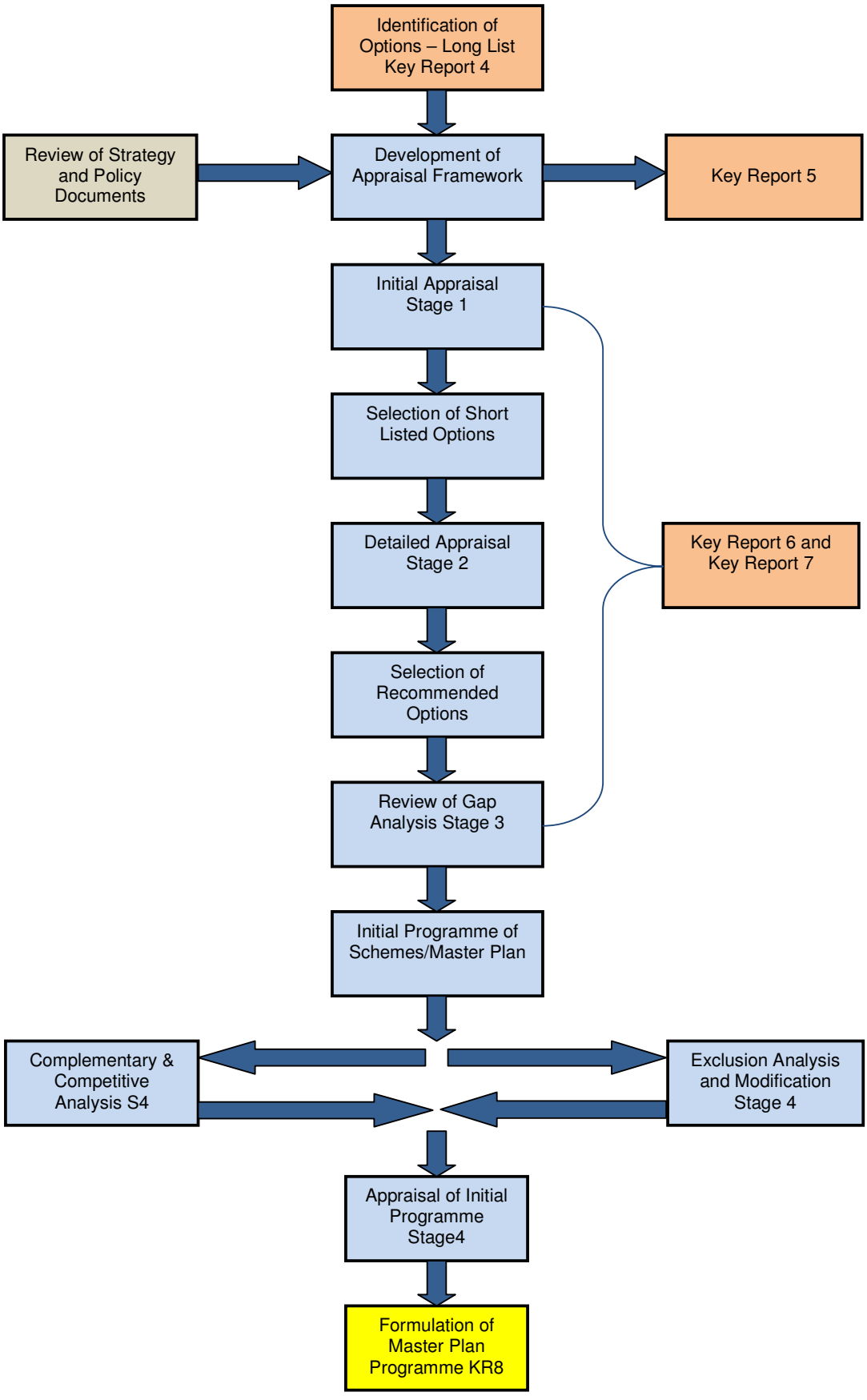
The initial appraisal of options and the recommendations on which options were dropped or which taken forward for detailed appraisal was reported to the Steering Committee and agreement reached on those options to take forward for more detailed appraisal.

7.3.2.2 Stage 2 – Detailed Appraisal

Whilst the initial appraisal was conducted using a qualitative framework, using the indicated scoring system, the detailed appraisal required a deeper analysis, using the transport models where appropriate, so as to give an indication of the valued/monetised benefits. Where possible preliminary estimates of costs and financial benefits for the short listed options were made and the economic benefits of improved transport system efficiency were considered at a broad level.

A number of the options being considered involved institutional or regulatory change or management (organisational) initiatives. It was not possible to appraise these options using the transport model and they were assessed in a qualitative manner.

Figure 7.1 – Appraisal Framework



The output of this stage of the appraisal included a more detailed assessment of the value of each option brought forward. The detailed appraisal also identified linkages between different elements of the Master Plan and allowed the development of combined options.

Ultimately, a final list of options was drawn up considered as candidates for inclusion in the overall General Transport Master Plan. These options are described in Chapter 8.

7.3.2.3 Stage 3 – Review of Gap Analysis

Following the identification and further analysis of schemes in the detailed appraisal, it was appropriate to reflect on the recommended options and whether they addressed the weaknesses and gaps to be overcome, as identified in Chapter 5.

During the review, those gaps and weaknesses which had not been effectively dealt with through the schemes proposed for the Master Plan were identified allowing consideration of whether or not any new options should be proposed that dealt with the gaps and weaknesses.

7.3.2.4 Stage 4 – Master Plan Development

The Stage 4 appraisal comprised a sifting and modification process, to isolate the complementary and competitive schemes in the emerging Master Plan. This included a process of excluding and modifying important schemes to check on their contribution to the whole Master Plan and the possibility for improving the overall performance.

The final part of Stage 4 of the appraisal was a more detailed analysis of the emerging Master Plan including development of the cost benefit analysis of the whole Master Plan. Following this task sensitivity testing of the Master Plan was undertaken using alternative economic and demographic scenarios.

The final output from the appraisal process is the recommended Master Plan which is reported in Chapter 9.

7.3.2.5 Summary of Development Process

The appraisal framework was designed to help ensure that the Transport Master Plan will assist in improving the economic, environmental and social well being of Bulgarian and other EU citizens. As such, the appraisal needed to consider wider gains and not focus solely on transport efficiency gains. The process for developing the framework included careful consideration of equity, especially for the Bulgarian citizens, and support for long term economic growth which needs to be sustainable.

The starting point for the development of the assessment framework is within existing EU guidance, specifically the policy priorities set out in the "National Strategic Reference Framework" and the framework used in the "National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan for the Period 2006-2015". It was important that the framework has clear linkages to EU and Bulgarian Government policy, so the contribution of each option to meeting public objectives is transparent.

The appraisal framework contains a number of headings covering the key indicators of:

- Costs and revenues;
- Contribution to economic growth;
- Social cost benefit analysis, following the approach presented in "Guidelines for CBA in Bulgaria";
- Environmental impact;
- Contribution to balanced regional development;
- Impact on transport safety and security; and
- Linkages with other projects.

Indicators of this type demonstrate the overall worth of each option in principle. However, the priority given to options which perform well will depend on a range of other factors including:

- Fundability - for example projects which relate to a TEN-T priority Axis are more likely to attract EU funding. This is linked in particular to the current (2007-2013) and future (2014 to 2020 and 2021 to 2027) OPT programmes;
- Absolute cost - both in terms of capital cost and long term maintenance;
- Timetable - for implementation, which will depend on the complexity of the option, the studies that have been undertaken to date and any further studies required to detail the option;
- Strategic Fit - with other options.

7.4 The GTMP Appraisal Framework

The GTMP appraisal framework was structured around those criteria that emerged from the review of international best practice and EU guidance. The criteria identified were designed to be consistent with both the initial and detailed assessment stages and appropriate for a balanced approach to the appraisal of options which ensured there was no bias towards a solely financial and economic cost benefit analysis.

The criteria were grouped under 8 principal headings with 46 objectives. The rationale for the choice of the 8 criteria headings is described in the following sections.

In the Stage 1 initial appraisal of options all objectives were scored using the 7 point qualitative scale. In the Stage 2 detailed appraisal options were scored using a combination of qualitative and quantitative values.

7.4.1 Strategic, Policy and Legal Criteria (Principal Criterion 1)

The "Guide to Cost Benefit Analysis of Investment Projects" (June 2006) produced by the Directorate General Regional Policy of the European Commission indicates that projects should contribute to the broad objectives of the EU regional and cohesion policies. For the Commission it is important that there is consistency with the main objectives of the European Regional Development Fund (ERDF) and Cohesion Fund. In the latter case, this means being consistent with the key priorities of the Operational Programmes, the European Community Strategic Guidelines for Cohesion and the National Strategic Reference Frameworks.

The fit with policy is vital to demonstrating consistency with objectives. Furthermore, being compliant with national and commission laws is a requirement that should not be left for consideration at a later stage (e.g. preparation of a funding application). In particular, any risks associated with state aid should be indicated in the appraisal process as this would impact on the delivery and implementation risks should a scheme be taken forward.

The options need to be balanced with the broader National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria Action Plan 2006-2015 and the National Demographic Strategy as well as key EC programmes such as the TEN programme.

Under the main strategic, policy and legal objective there are 11 sub-objectives:

- Creation of Trans-European Network;
- Effective maintenance, modernisation of the transport infrastructure;
- Integration of the Bulgarian transport system in the EU transport system;
- Development of intermodal transport including rail and highway modes;
- Development of sustainable transport;
- Support balanced territorial development;
- Enhance the regional tourism potential;
- Development of the national road infrastructure;
- Development of rail infrastructure including cross border and those of European importance;
- Development of main port infrastructure and modernising River Danube and sea waterway infrastructure; and
- Development of airport capacity and linkages.

7.4.2 Financial and Economic (Principal Criterion 2)

The financial and economic criteria adopted for appraisal of options in the GTMP are derived from the national and EC documents introduced in Section 7.2.5.

Economic appraisal is the common factor within all appraisal frameworks. This is required by the EU as a key part of their appraisal process. The economic and financial criteria are used to illustrate the value for money to society and justify the overall public cost of the scheme. This allows for the most appropriate allocation of limited resources.

The main valuations for these criteria and other criteria are taken from the "Requirement for preparation of CBA in transport sector" (October 2008).

Under the financial objective there are three sub-objectives:

- Capital expenditure;
- Operating expenditure per annum; and
- Revenues from activities.

Under the economic objective there are eight sub-objectives:

- Impact on traveller time;
- Impact on private vehicle operating costs;
- Impact on freight operating costs;
- Impact on public transport operating costs;
- Impact on public transport revenues;
- Improved accessibility to Ports, Airports and major economic centres;
- Additional transport capacity; and
- Cost Benefit Analysis.

7.4.3 *Social Criteria (Principal Criterion 3)*

The drive for economic growth can cause significant disparity in a developing country. The growth of the emerging middle class leaves a significant proportion of the population in social and economic poverty. The urbanisation seen with the growth of Sofia, although beneficial in aggregate terms (at a national level), has resulted in significant disparity between regions with some entering a period of decline. In the framework the social impact of transport investment was considered at a strategic level and examined the disparity between regions and between the impact on major urban areas, small towns and rural areas within each region.

The distribution of economic growth is a key concern for the Bulgarian Government as well as the EU. Each option considered in the appraisal framework needed to be considered in terms of its contribution to balanced economic development across the country and within employment sectors and across socio-economic groups. A balanced approach makes the economy more resilient to external events.

Under the social criteria there are six sub-objectives:

- Accessibility for the socially disadvantaged;
- Support for the urbanisation of towns and cities other than Sofia;
- Opening up of employment opportunities and access to these opportunities throughout the Country;
- Support to areas vulnerable to manufacturing decline;
- Support for indigenous jobs; and
- Improve the skills base through extension of capabilities.

7.4.4 *Environmental Criteria (Principal Criterion 4)*

Transport-related activities can have a range of environmental effects. These include effects on ecological interests caused by the construction of new infrastructure and increases in CO_2 emissions; contributing to global climate change.

The EU is clear that as far as possible positive and negative externalities such as environmental impacts should be accounted for within the cost benefit analysis. These impacts are included in the appraisal framework, even at the early stage of the sifting through the long list of options, due to the increasing weight that is placed on environmental externalities especially when an option being considered has a negative impact.

Under the environmental objective there are eight sub-objectives:

- Effects on biodiversity, flora and fauna;
- Effects on water;
- Effects on soils and material assets;
- Effects on landscape;
- Effects on cultural heritage;
- Effects on population and human health (including local air quality and noise);
- Effects on protected areas; and
- Contributions to global climate change - CO_2 emissions.

In addition there has been a separate and more detailed strategic environmental appraisal (SEA). This has been submitted as a separate and self-contained report but is summarised in section 9.8 to this report.

7.4.5 *Safety and Security (Principal Criterion 5)*

The high accident rate on the highway network is a significant cost to the Bulgarian economy with fatalities on the highway alone costing in the region of €600m per annum and hence modal shift or improved highway and rail infrastructure should be expected to generate significant benefits.

In transport studies throughout Europe and in much of the rest of the World the impact of accidents is valued in terms of the loss of earnings to the economy and the cost of emergency service intervention at the time of the accident and the pain, grief and suffering of family of someone killed in an accident. In the

appraisal framework the cost of a fatal accident has been based on the CBA Guidelines for Transport Sector 2008 which takes account of the disparity in wages and salaries between Bulgaria and the EU27.

Safety and security systems in water and air transport are very well developed due to the historically traditional high requirements for this mode of transport. Nevertheless, personal security of passengers when travelling, especially on public transport, currently has high priority in many Western European countries and is often valued when assessing the impacts of security measures.

Under the safety and security objective there are four sub-objectives:

- Reduction of Fatal Accidents on the Road;
- Improved personal safety;
- Enhancement of the safety levels; and
- Enhancement of security levels.

7.4.6 *Fundability (Principal Criterion 6)*

The main sources of funding of transport schemes are:

- Cohesion Funding;
- European Regional Development Fund;
- National Funding;
- Municipality/regional funding;
- Private finance – concession/contractor/operator;
- Private finance – financial institutes/pension funds; and
- Traveller revenue – tolls, fares, etc.

Each scheme has been assessed regarding the likelihood of attracting funds from the above sources.

Under the fundability objective there are two sub-objectives:

- Likelihood of receiving EU or national funding; and
- Increase in the use of private capital in the implementation of transport development schemes.

7.4.7 *Deliverability (Principal Criterion 7)*

The state of readiness of each option is a key attribute and the potential for delivery by 2015 and/or for inclusion in the next OPT periods is a major part of the selection process. The funding for the current OPT is already available and a scheme that can be quickly introduced will be able to generate early benefits for Bulgaria in social, environmental and economic terms.

Schemes after 2015 will be introduced into the next OPT documents, however the administrative and funding arrangements for future schemes have not been agreed nor will they be until the Commission has signed off each of the future OPTs. Schemes that can be introduced up to 2015 will need to have an agreed CBA and financing approach and therefore have less uncertainty attached.

There is only one sub-objective under the deliverability objective and that is the state of readiness of the project.

7.4.8 *Risk (Principal Criterion 8)*

The delivery of any scheme can be subject to a range of risk factors which could delay or stop a project or result in the option being changed. In the context of the GTMP appraisal we are primarily concerned with risk factors which are external to the project.

Under the risk objective there are three sub-objectives:

- Assessment of risk on schemes performance from market forces;
- Assessment of risk on schemes performance from institutional constraints; and
- Assessment of risk on schemes capital expenditure and operating expenditure.

7.4.9 *Appraisal Summary Table*

Comparison of performance of an option against objectives and against each other was simplified by using a common assessment summary table. The template for this table is shown in **Table 7.1.**

Table 7.1 – Assessment Summary Table Template

Objective	Sub-Objective	Qualitative Impacts	Quantitative Assessment	Qualitative Assessment
Strategic, Policy and Legal	Creation of Trans-European Network			
	Development of intermodal transport			
	Development of sustainable transport			
	Development and maintenance of the transport infrastructure and capacity			
	Enhance the regional tourism potential			
Economic and Financial	Capital and Net Operating Expenditure			
	Transport Economic Efficiency: Passengers			
	Transport Economic Efficiency: Freight			
	Capacity			
Social Criteria	Accessibility for the socially disadvantaged			
	Creation and support of employment opportunities			
	Support for the urbanisation of towns and cities other than Sofia			
Environment	Biodiversity			
	Water Environment			
	Soils & Material Assets			
	Landscape			
	Cultural Heritage			
	Population & Human Health			
	CO_2 Emissions			
Safety and Security	Accidents			
	Security			
Fundability	Likelihood of receiving EU, national or private funding			
Deliverability	State of preparation of the scheme			
Risk	Assessment of risk on schemes performance and capital and operating costs			

8 Appraisal of Options

8 Appraisal of Options

8.1 Introduction

All 134 options identified, and as listed in Tables 6.2 to 6.6 were subject to an initial appraisal to allow exclusion of those that did not significantly contribute to the objectives of the GTMP or which were unlikely ever to be delivered because of their cost or overriding negative impact. In summary the options comprised:

- Highway Options – 33;
- Rail Options – 25;
- Water Options – 56;
- Air Options – 15; and
- Intermodal Options – 5.

Each option was appraised using the appraisal framework presented in Chapter 7, with the 46 individual criteria marked on a qualitative score ranging from -3 to +3.

From the long list of 134 a total of 87 individual options progressed to the detailed appraisal stage. Some remained as individual options while others were combined. After combination the short list was reduced to 62:

- Highway Options and Combinations – 19;
- Rail Options and Combinations – 17;
- Water Options and Combinations – 16;
- Air Options and Combinations – 5; and
- Intermodal Options – 5.

Each of the 62 options/option combination on the short list were appraised in more detail and where appropriate were subject to a Cost Benefit Analysis. From the short list 56 were carried forward for consideration within the Master Plan.

8.2 Appraisal Summary

The following sections examine each of the 134 options on the long list and describe the decisions taken during the initial and detailed appraisal stages. The results of the appraisal are presented in the following sections for each main mode of transport.

The decision on whether or not to carry forward an option was not made solely on the summation of the qualitative scores for any particular scheme because a simple score threshold can be both misleading and result in options being dropped where they have particular merit and value. There are a number of examples where this could be the case:

- An option related to management and regulation may not score as highly as an infrastructure scheme because the benefits it produces are less tangible, nevertheless it may be both cheap and relatively simple to implement and be fundamentally important to ensure the most efficient management and operation of the transport system;
- A major infrastructure proposal whilst scoring highly on the benefits side may be marked down because of significant environmental concerns and other risk factors. Overall therefore it may only score modestly. Despite this it could be a very important scheme in the context of strategic national and international connections and it may be possible to reduce or mitigate the adverse environmental and risk factors; and
- A smaller infrastructure project may not score as highly as a major project because it effects are more limited, however, it could still be a vital element of a much broader strategy or an approach to a whole corridor. In addition it may also be possible to deliver the option quickly and with minimal risk.

Accordingly the decision on whether or not to carry forward an option, whilst being based on the results of the framework appraisal, also drew on a review of the option in a broader context and the professional judgement of the key experts on whether it had the potential to provide a significant contribution to the ultimate overall Master Plan.

Where a scheme was recommended as one not to carry forward this was not a judgement on the value of the scheme in itself, only on its potential value in contributing towards an effective national transport master plan. In particular there are likely to be schemes, options or initiatives that have only a relatively local influence which will be worth further investigation as part of different studies or programmes, but not as part of the General Transport Master Plan.

8.3 Highway Options

8.3.1 *H01 – Review of Roads Infrastructure Administration and Network Hierarchy*

The option will review the organisational structure for strategic highways within Bulgaria where currently the Agency for Roads Infrastructure (ARI) is responsible for all public roads outside the municipalities. It will also review the classification of roads.

The primary objective would be to develop a management structure for highway infrastructure that would have clearly delegated responsibilities between the Ministry of Transport, ARI and regional and local authorities. This would contribute to improved efficiencies of operation and the ability to deliver new highway schemes of national importance more quickly, while allowing regional agencies to focus on meeting more local needs.

A secondary objective would be to verify if the current highway classification reflects the role played by some roads.

A better managed strategic highway network has the potential to save passenger and freight travel time bringing greater economic efficiency to highway transport. The option also has the potential to indirectly but positively affect accident rates by promoting early completion of highway schemes.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.2 *H02 - Review of Options for Infrastructure Funding and Revenue Generation*

A big problem facing Bulgaria is that there are insufficient funds for new construction, repairs and maintenance of existing road infrastructure against a background of many years of underinvestment. Many strategically important schemes have been delayed or cancelled because of the lack of public funds and the absence of private sector involvement.

The proposal is for a review of options for funding and revenue generation with the primary objective of promoting infrastructure investment by a more effective use of private sector finance in addition to EU and state funding along the lines of other European countries where private companies have become involved in the designing, building, financing and operating of new schemes in the context of direct or shadow tolls.

Improvements in access to and delivery of a range of alternative public and private funding sources will be beneficial for faster delivery of schemes and more effective maintenance. Promoting flexible charging and toll collection could attract more private investors to the sector of designing, constructing, operating and maintaining highway infrastructure.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.3 *H03 - Development of a Network Maintenance Plan*

Develop proposals for a funded, prioritised and programmed maintenance plan to tackle the inadequate and inconsistent maintenance of the existing assets and the negative impact this has on the quality, reliability and safety of the service provided to users.

Recommendation – combined with H04 and carried forward from the long list for consideration of inclusion in the Master Plan

8.3.4 *H04 - Establishment of a Highway Asset Condition Monitoring System*

Develop proposals for establishing a highway asset condition monitoring system as an integral part of management and maintenance of the highway network.

Recommendation – combined with H03 and carried forward from the long list for consideration of inclusion in the Master Plan

8.3.5 *H05 - Development of a Road Safety Information and Education Campaign*

It is acknowledged that trends in accident numbers and casualty severities in Bulgaria are still rising and that in comparison with other European countries Bulgaria is one of the worst performers.

The proposal is for a review of options for the development and implementation of a national road safety information and education campaign. Together with infrastructure improvements, improved highway maintenance and a system for driver information, an information and education campaign should have the

objective of improving the accident rate and severity in the country to match the average for the EU 27 states by 2020.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.6 *H06 - Feasibility Study for a National Driver Information System*

Currently, with the exception of some radio broadcasts, there is no information provided to drivers before or during their journey on accidents, congestion or other problems on the highway network.

The proposal is for a feasibility study for the introduction of a National Driver Information System to provide drivers with information about congestion, accidents and other problems on their routes both before and during their journeys. It could also provide information on available alternative travel options.

The main benefits of an implemented scheme would be passenger and freight travel time savings and vehicle operating costs savings by significantly reducing idle time in congestion and offering better utilisation of the whole network.

Recommendation – carried forward from the long for consideration of inclusion in the Master Plan

8.3.7 *H07 - Review of Academic and Professional Training and the role of Research Institutes*

Whilst Bulgaria has well developed skills in highway design and operation backed by good academic training there is a lack of skills and understanding of some of the basic principles of transport planning, notably feasibility studies, transport modelling and transport cost benefit analysis.

The proposal is for a review of training and the contribution that research institutes can make with the objective of providing a more efficient and effective environment within which transport schemes in general and highway schemes in particular are developed and delivered.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.8 *H08 - A1 Motorway "Trakia" Stara Zagora to Karnobat*

The completion of the Trakia highway to link the capital city of Sofia with the Black Sea along a continuous high speed road will meet many of the most important strategic transport, policy, economic and safety criteria for justification of investment. Whilst the scheme will be expensive, funding should be available from the OPT and whilst there will be significant environmental impacts it should be possible to mitigate them to a satisfactory level. The scheme is very important not only to improving road transport but also in supporting connectivity to the Black Sea ports and helping to support existing and stimulating new export, import and transit trade.

The scheme has been developed over a number of years and a range of preparatory studies have been undertaken, the scheme could therefore proceed very quickly.

The scheme has been subject to a CBA with very positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 384 m	€ 2,207 m	€ 1,824 m	5.75

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.9 *H09 - A1 Motorway "Trakia" Sofia Ring Road to Kalotina (Serbian Border)*

Whilst traffic flows on the section of motorway "Trakia" to the west of Sofia are significantly lower than to the east, the route is nevertheless of strategic international importance providing the most direct highway route to western Balkan countries and until the opening of the Vidin Bridge the most direct road connection to the rest of Western Europe.

The current standard of the road, following recent rehabilitation is 4 undivided lanes from Sofia to Slivnitsa and 2 lanes from Slivnitsa to Kalotina. This standard is appropriate for both the existing traffic and traffic forecast to 2030.

The scheme to upgrade the road to full motorway standard was passed from the long list of options to the short list and was then subject to a CBA:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 244 m	€ 145 m	€ -100 m	0.59

This demonstrated that the scheme provided very poor value for money and was therefore very unlikely to secure funding.

Recommendation – not carried forward in to the Masterplan

8.3.10 *H10 - A2 Motorway "Hemus" Sofia Ring Road to Yana*

International and domestic traffic coming from the south west region of Bulgaria with destinations in the northern half of the country and Romania would naturally follow the Hemus highway from Sofia. However the first section of the route between Sofia Ring Road and Yana is not complete and all traffic has to use unsuitable poor standard roads which run through built up and residential areas. This severely affects the journey times and the safety for travellers.

The scheme is for the construction of new section of motorway – Sofia Ring Road to Yana (8.5 km, D2M standard) to provide a motorway connection between Sofia and the existing motorway to Yablanitsa and divert traffic away from the congested Class 1 road.

The scheme has been subject to a CBA with very positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 32 m	€ 132 m	€ 100 m	4.15

Completion of this missing link on Trans-European Network Corridor IV will have significant strategic transport benefits.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.11 *H11 - A2 Motorway "Hemus" Yablanitsa to Shumen*

Proposals for the completion of Motorway "Hemus" from Yablanitsa to Shumen have been an integral part of long-term planning for a strategic high standard motorway network for Bulgaria for many years. The route, whilst not part of a Trans-European Network Corridor does provide strategic national and international connections linking the capital Sofia with the important Black Sea port of Varna, the crossing to Romania at Ruse, as well as with the new ferry lines alongside the Danube bank.

The motorway is of strategic significance for the development of 43,7% of the territory of Bulgaria, which comprises of three planning regions – North-western, Northern Central, and North-eastern. Its completion will enhance the transport accessibility of the cities in Northern Bulgaria, which implies that Hemus motorway will have the potential to significantly improve strategic national and international connection and support the economic development of the country.

The scheme has been subject to a CBA with the following results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 1,166 m	€ 1,477 m	€ 311 m	1.27

The scheme produces very large benefits but because of the very high costs the net present value and benefit to cost ratio are relatively low.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.12 *H12 - A3 Motorway "Maritsa" Chirpan to Harmanli*

Construction of a new motorway to link with the existing Trakia Highway at the Orizovo road junction to Harmanli where it would connect with the recently constructed motorway to the Turkish Border at Kapitan Andreevo. This construction would provide a continuous high quality motorway standard route from Sofia to Istanbul along TEN-T Corridor IV.

The existing single carriageway Class I road has limited capacity and runs through a large number of towns and villages with consequent congestion and environmental problems. These problems are made worse by the high proportion of international freight transit traffic.

The scheme is an advanced state of preparation with designs ready and land acquisition expected to be complete by the end of 2009.

The scheme has been subject to a CBA with the following results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 227 m	€ 251 m	€ 24 m	1.10

Whilst the scheme only produces modest benefits, its strategic importance to the enhancement of European connectivity makes it a very strong candidate for funding.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.13 *H13 - A4 Motorway "Black Sea" Burgas to Priseltsi*

The Black Sea Motorway like Trakia and Hemus has been planned for many years. By linking the two east west motorways and the major coastal port cities of Varna and Burgas it will provide a motorway "box" for the whole country and also form an important connection as part of Trans-European Corridor VIII. In 2006 8 km of the motorway were completed, from the Asparuhov Most Bridge in Varna south to the village of Priseltsi.

Whilst there are concerns regarding the environmental impact of completion of the route it will significantly improve connectivity to the Black Sea ports and therefore support their long term sustainability and economic development. It will also contribute to the tourism potential of the area.

The scheme has been subject to a CBA with the following positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 408 m	€ 802 m	€ 393 m	1.96

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.14 *H14 - A6 Motorway "Struma" Dolna Dikanya to Kulata*

Proposals for the completion of Motorway "Struma" from Dolna Dikanya to Kulata have been an integral part of long-term planning for a strategic high standard motorway network for Bulgaria for many years. It lies on Trans-European Network Corridor IV. The border crossing to Greece at Kulata is the busiest road crossing into and out of Bulgaria. The first section of the route between the southern end of Motorway "Lyulin" and Dolna Dikanya was opened in 2008.

The remaining sections have been the subject of much preparatory planning and design work but have been delayed because of high construction costs and significant environmental constraints. Nevertheless it has significant potential for the country as a strategic nationally and internationally important route.

The scheme has been subject to a CBA with the following positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 608 m	€ 935 m	€ 327 m	1.54

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.15 *H15 - Sofia Ring Road Northern Arc*

Piecemeal improvements have been made to the Sofia Ring Road over a number of years with the objective of bringing it up to a standard appropriate for carrying long distance strategic transit traffic around the capital city. For it to provide this function and to remove all through traffic from the City will require further work to various sections of the road with a view to improving it to a consistent dual carriageway standard with grade separation of the important junctions and closure of the less important ones.

The scheme has been subject to a CBA with the following very positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 101 m	€ 696 m	€ 595 m	6.88

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.16 *H16 - Sofia Ring Road Southern Arc*

The same general comments that applied to the Northern Arc also apply to the Southern Arc. The major difference is that the Southern Arc runs much closer to the city and significant development has grown up

alongside the route adding to the traffic using it and the complications of finding room to improve the road without the need for property demolition and the dangers of negative environmental impacts.

The scheme has been subject to a CBA with the following very positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 51 m	€ 981 m	€ 929 m	19.05

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.17 *H17 - Rila Highway Dupnitsa to Motorway "Hemus"*

The construction of a new highway linking the Struma, Trakia and Hemus Highways has potential benefits in improving access to and the development of ski tourism in the Rila Mountains and also in providing a more direct route for strategic traffic between the motorways and so reducing traffic around the capital Sofia and the congested ring road.

There will however be major issues related to negative environmental impact resulting from the road passing through areas of high landscape value and high cost because of the hilly terrain through.

The scheme has been subject to a CBA with the following positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 209 m	€ 665 m	€ 456 m	3.19

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.3.18 *H18 - II99 Southern Black Sea Coast Road*

The option for a significant upgrade for the coastal highway from Sozopol south to the Turkish border was considered because the existing road is in very poor condition and it is a deterrent to tourists who might otherwise visit this largely undeveloped area of coast.

Improving the road may increase traffic and therefore encourage more property development along the coast and so satisfy criteria related to enhancing regional tourism potential and supporting existing and generating new jobs. However this would be at the expense of significant harm to the environment on one of the few remaining unspoilt sections of coast. Additionally the scheme does not satisfy the core objectives of promoting the national and international transport system.

Recommendation - not carried forward in to the Masterplan

8.3.19 *H19/H20/H21/H22 - I1/E79 Botevgrad to Dimovo*

The 4 options all form part of an improved connection between Sofia, the Motorway "Hemus" and the new Vidin Bridge across the Danube linking Bulgaria with Western Romania and onwards to the rest of Western Europe along Trans-European Network Corridor IV. As such they can be considered together with the improvements bringing the whole route to a higher and consistent standard. The proposal is for a consistent D2AP standard between Botevgrad and Montana with bypasses of Vratsa and Montana and improved S2AP standard from Montana to Vidin.

Whilst traffic flows on the route are relatively low at present the opening up of the Vidin Bridge combined with increasing trade between Bulgaria, Turkey, Greece and Western Europe gives the potential for higher traffic demands and the need to support strategic trade with a higher standard route.

The combined scheme has been subject to a CBA with the following positive results:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 108 m	€ 273 m	€ 164 m	2.51

Recommendation – carried forward as a combined scheme from the long list for consideration of inclusion in the Master Plan

8.3.20 *H23/H24 or H25/H26/H27/H28 - I5/E85 Ruse (Romania) to Makaza (Greece)*

These five options all form part of an improved strategic north south route connecting important cities in the north and south of the country and also international connections to link Bulgaria, Romania and Greece. As such they can be considered together with the improvements bringing the whole route to a

higher and consistent standard. The route follows Trans-European Network Corridor IX. The route is difficult because it crosses the high Balkan Mountains and is liable to be closed in winter because of adverse weather conditions.

There are two options to be considered for crossing the mountains, firstly via the higher route, the Shipka Pass (H24), with the construction of a tunnel, and secondly via the Pass of the Republic (H25), a lower but slightly less direct route.

Traffic flows on the northern and central sections of the route are higher than those south of Kardzhali because the border crossing to Greece at Makaza is not yet open. The opening of this new facility and the connections to the Aegean Sea and the east west Greek coastal motorway are likely to increase traffic demands throughout the route.

The two options for a combined scheme have been subject to a CBA.

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
Shipka Pass Route			
€ 753 m	€ 1,103 m	€ 350 m	1.46
Pass of the Republic Route			
€ 475 m	€ 1,005 m	€ 530 m	2.12

The cost benefit analysis comparison between the two options showed that whilst the benefits from a Shipka route were marginally higher, the construction costs were very significantly more.

Recommendation – both options carried forward as combined schemes from the long list for consideration of inclusion in the Master Plan.

8.3.21 *H29 - I3/E83 Yablanitsa to Byala*

This route currently provides the main road connection between the western half of Bulgaria, and the capital city, and Romania via the bridge at Ruse. The standard and maintenance of the route have been progressively improved and the main part of the route provides a high quality and relatively fast road.

The construction of the Motorway "Hemus" would result in the transfer of traffic from the route and a reduction in its importance as a strategic road connection. Even if the construction of Hemus were delayed or dropped there would be little justification for any additional investment in the route based on any realistic forecast of growth in traffic.

Recommendation - not carried forward in to the Masterplan

8.3.22 *H30 - II62 Kyustendil to Dupnitsa*

Improvements to this route were considered as a way of providing a better connection from Macedonia and the border crossing at Gyueshevo with the Struma Highway and potentially the Rila Highway if it were to be constructed.

A review of the traffic flows and of the potential for any increases resulting from more traffic and trade with Macedonia revealed that the existing road II62 and the connection to Sofia via the I6 are both of a good standard and appropriate to carry the volumes of traffic predicted. There is little merit in this option particularly as a route of strategic and national/international importance.

Recommendation - not carried forward in to the Masterplan

8.3.23 *H31 - I2/E70 Shumen to Ruse*

The link between the Black Sea and Ruse via Shumen is of strategic national/international importance and it is appropriate that the route should be of a sufficiently high standard to serve that purpose and provide a reliable journey with good journey times.

Inspection of the road showed it to be of a good standard and well maintained providing a high quality and relatively fast road. This standard is appropriate to carry the forecast volumes of traffic in this corridor for many years.

Recommendation - not carried forward in to the Masterplan

8.3.24 *H32 - I9/E87 Burgas to Malko Tarnovo*

The road from Burgas whilst providing a direct connection to Turkey at Malko Tarnovo is primarily of local/regional importance. Traffic flows on the road and crossing the border itself are currently very low. There is little justification for any improvement in the context of a strategic enhancement to support the objectives of the General Transport Master Plan.

Recommendation - not carried forward in to the Masterplan

8.3.25 *H33 - II29 Varna to Kardam*

The road from Varna whilst providing a direct connection to Romania at Kardam is primarily of local/regional importance. Traffic flows on the road and crossing the border itself are currently very low. There is little justification for any improvement in the context of a strategic enhancement to support the objectives of the General Transport Master Plan.

Recommendation - not carried forward in to the Masterplan

8.4 Rail Options

8.4.1 *R01 - Railway Administration*

Network maintenance along with operation of passenger and the majority of freight services is all under the ownership and operation of the state government. However, there is the potential for improving the co-ordination between the management of these different sectors especially as there is no strategic plan currently in place for future rail development. A review of the national and regional organisational structures is required to identify areas for efficiency improvements within departments and to enhance communication and working within and between individual companies.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.2 *R02 - Funding and charging*

Funding is currently planned on a yearly basis, not allowing for any medium or long term planning of investment in enhancement projects, or for the renewal and maintenance of existing assets. This approach can restrict opportunities for cost savings that can be achieved by taking a more strategic approach in these areas. Any review of options for infrastructure funding and revenue generation will require the definition of railway systems and policies. This will enable forward investment programmes for train operators and infrastructure managers to be planned in a manner consistent with the railway planning timescales and in ways which give confidence to external funders. The option has the potential to provide a highly effective mechanism to inject confidence into the market and facilitate additional investment.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.3 *R03 - Network, Station & Facilities Rationalisation*

The current condition of the railway infrastructure varies considerably across the network. In some locations the original design specification of the infrastructure greatly exceeds the current needs of the network, creating a problem of having to maintain underutilised infrastructure assets. This creates an increased burden on maintenance costs, and these limited funds could be spent more efficiently if a rationalisation of under-utilised assets were to take place. The option requires the definition of network functionality and a review of existing infrastructure, the network size and its capability. The objective would be to introduce processes to create a rail network designed to meet current and future transport needs. This is likely to require rationalisation of stations, facilities and routes where long term revenue expectations are below the long run expected costs.

Recommendation - carried forward from the long list for consideration of inclusion in the Master Plan in combination with R04

8.4.4 *R04 - Freight Facilities Rationalisation*

The current provision of freight facilities, in the form of reception lines, sidings, crane and haulage equipment is in poor condition in many cases. Freight facilities need to be reviewed within the same framework as option R03 to identify those assets that are currently still being maintained even where they are under-utilised and there is little prospect of increased utilisation in future. Considerable opportunities exist for facility reform and reducing the unit cost of provision.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan in combination with R03

8.4.5 *R05 - Asset & Information Management*

Maintenance of existing infrastructure assets on the rail network is inefficient and inconsistent, with differing standards. This is having a negative impact on the quality, reliability and safety of the service for all users and also increasing maintenance and operating costs as a result of the inefficient maintenance programme. This option entails the preparation of a comprehensive management information system and asset register to provide an effective record of what assets exist, their condition and maintenance profile.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan in combination with R06

8.4.6 *R06 - Network Maintenance Plan*

As R5 notes, the current planning and programme of maintenance of the rail network is inconsistent, leading to adverse impacts on the performance of the system in terms of reliability and journey times. There is a requirement to develop an efficient plan to target infrastructure system maintenance and allocate resources to meet emerging route demand. It is considered that this is an ongoing requirement and will need to be undertaken after any system rationalisation and reflect overall route condition and investment criteria. A more efficient maintenance regime should also generate operating cost savings and reduce journey times.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan in combination with R05

8.4.7 *R07 - Speed Enhancements*

Journey times on key routes have been extended in recent years and are generally longer than by road. Permanent and temporary speed restrictions due to a lack of maintenance, impact on capacity and performance. In addition, the lack of modern rolling stock and traction power has also been a contributory factor to the poor journey times by rail in comparison with the highway network. The current level of performance of the network means that a review of opportunities for higher speed services is required. This involves the identification of operational planning opportunities, followed by the potential to improve rolling stock performance and capability to reduce journey times.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.8 *R08 - Passenger Facilities*

Existing passenger facilities at stations are well below European norms and as such give the perception that rail travel is of a poor quality and difficult to use, for both local and international travellers. Many of the station facilities are out dated and do not provide minimum standards of security and safety. It is therefore likely that they are discouraging passenger use. Under this option, a plan would be developed for the upgrading of passenger facilities at stations.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.9 *R09 - Passenger Information*

Information availability to passengers throughout the complete journey experience is of a poor standard. The lack of access to timetable, train running and availability information, acts in many cases as a deterrent to using this mode of transport hence the need for a plan for upgrading information for passengers. It is recommended that defined minimum standards of required information are established for all system users. Strategies can then be developed within other activities (for example command and control upgrades) which meet these requirements.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.10 *R10 - Training and Education*

Railways traditionally have a high standard of technical educational development. In many cases it has been difficult to retain the best and most able students within the railway organisations. In addition a focus on modern strategic business management training should provide the basis on which ongoing reform of the business can be undertaken. A training reform programme, building on existing best practices should provide suitably qualified personnel to lead future railway activities. A first stage would be to review academic and professional training and the role of research institutes.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.11 *R11 - Locomotives & Rolling Stock*

A significant proportion of passenger and freight rolling stock and motive power remain below appropriate standards. This impacts on both the quality of the services offered (in terms of reliability, safety and comfort) and cost of operation. There is an adverse impact on both infrastructure operation and

maintenance requirements. Although some progress has been made a programme of locomotive and rolling stock modernisation could deliver significant benefits in relation to the objectives of the Master Plan.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.12 *R12 - Vidin to Sofia*

This route will become increasingly important on the completion of the second Danube crossing, providing an important cross-border route. The route forms part of TEN-T Corridor IV and EU Priority Project 22 (Athens - Sofia – Budapest – Vienna – Prague – Nuremburg) Railway Axis. The route is of strategic importance and major upgrades to maintain existing functionality and to enhance route capacity and speed will be important. As well as providing journey time and reliability benefits, this option would also assist in supporting all objectives that relate to the increased growth of rail as a mode. It would also assist in providing improved rail linkages with neighbouring European countries.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 399 m	€ 236 m	€ -163 m	0.59

We recommend taking forward this option despite a negative NPV and a BCR of less than one. At this stage, we have only considered the benefits to the existing service. There is potential to create better options which combine improvements to services, rolling stock and information (as covered in other options) with infrastructure investment. This comment applies equally to other rail infrastructure options.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.4.13 *R13/R18/R19 - Sofia to Burgas and Varna via Plovdiv*

The three options together form the strategically important southern route between Sofia and the Black Sea Ports of Burgas and Varna along TEN-T Corridor VIII, and provide an important part of the international route to Turkey (TEN-T Corridor IV). The current route has many natural speed restrictions and capacity constraints making the rail offer relatively uncompetitive compared to other modes. To ensure this route will meet the future requirements will require the renewal of existing infrastructure, systems and enhancement of operational performance.

The scheme is very important not only to improving rail transport but also in supporting connectivity to the Black Sea ports and helping to support existing and to stimulate new export, import and transit trade.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 755 m	€ 421 m	€ -334 m	0.56

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme. Further consideration to be given to the introduction of higher speed tilting trains.

8.4.14 *R14/R15/R16 - Sofia to Kulata (Greek Border)*

The three options together form the strategically important route between Sofia and the Greek Border at Kulata along TEN-T Corridor IV. It is also along the line of EU Priority Project 22 (Athens - Sofia – Budapest – Vienna – Prague – Nuremburg) Railway Axis. The route is capacity constrained and journey times remain uncompetitive. In addition, there is growing commuter demand for passenger rail services on the Sofia – Pernik corridor which is currently being constrained. Route enhancement measures and the removal of constraints affecting journey times and operational performance have significant potential. As well as providing journey time and reliability benefits, this option would also assist in supporting all objectives that relate to the increased growth of rail as a mode. It would also assist in providing improved rail linkages with neighbouring European countries.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 233 m	€ 151 m	€ -82 m	0.65

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.4.15 *R17 - Sofia to Kalotina (Serbian border)*

This route is on the strategic corridor to Serbia (TEN-T Corridor X) and is both capacity constrained and in need of additional maintenance and restoration. It has significant local and strategic freight flows. However these are likely to reduce once the Vidin – Calafat Bridge opens. Any route upgrade and enhancement strategies should be developed in line with expected low growth in service demand. In this context, to renew existing infrastructure systems and enhance operational performance on this route is likely to be considered a second order option.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 71 m	€ 21 m	€ -50 m	0.30

Recommendation – not carried forward in to the Master Plan

8.4.16 *R20 - Sofia - Karlovo - Stara Zagora*

This is a secondary route between Sofia and Stara Zagora and is in need of investment to maintain system functionality. This would entail track upgrade and re-signalling. Any decision to address the long term condition of this route will need to be undertaken within the context of the emerging demand for freight services and the review of the size and future shape of the rail network. It is recommended that any decision in respect of this route is deferred until this review is complete.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 78 m	€ 18 m	€ -60 m	0.23

Recommendation – not carried forward in to the Master Plan

8.4.17 *R21/R22 - Mezdra to Varna via Gorna Oryahovitsa*

The renewal of existing infrastructure systems, mainly tracks and signalling, is required on the section of the network to enhance the operational performance. This route is part of the northern east – west axis between Varna and Sofia and is therefore important to both domestic and international freight and some passenger services. Some parts of the route are in good condition however system enhancement is required to maintain functionality. As well as providing journey time and reliability benefits, this option would also assist in supporting all objectives that relate to the increased growth of rail as a mode.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 760 m	€ 559 m	€ -201 m	0.74

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.4.18 *R23/R24 – Ruse to Stara Zagora*

Part of TEN-T Corridor IX this option requires renewal of existing infrastructure systems including track upgrade and re-signalling to enhance operational performance. It is on the strategic north – south axis utilising the existing crossing of the Danube to Romania and giving access to the growing markets in Turkey. The route currently is in poor condition with significant capability reductions. Any schemes should seek to restore planned route functionality and give attention to upgrading traction power supplies and systems. As well as providing journey time and reliability benefits, this option would also assist in supporting all objectives that relate to the increased growth of rail as a mode.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 161 m	€ 83 m	€ -78 m	0.51

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.4.19 *R25 - Ruse to Kaspichan*

This route links the Port of Varna with the existing crossing of the Danube in to Romania at Ruse. The route requires upgrading to maintain and restore existing functionality. Any option is likely to give early consideration to strategies designed to maintain planed system performance. Any capability enhancement upgrades should be undertaken within the context of the review of overall rail system capability.

The scheme has been subject to a CBA with the following result:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
€ 44 m	€ 8 m	€ -38 m	0.17

Recommendation – not carried forward in to the Master Plan

8.5 Port and Waterway Options

8.5.1 *W00/W01/W02 – Port Operational Assessments and Certification, and upgrading of Safety, Environmental and Security Measures*

Three individual options were identified aimed at bringing operations in Bulgarian ports up to internationally recognised standards. They addressed regulations associated with operations, safety and the environment, and security. They jointly will help to ensure compliance with European and broader international norms.

If the Bulgarian ports fall behind in progress on meeting international standards there is the very real risk that they will lose out in attracting trade in competition with ports in neighbouring countries.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.5.2 *W03 – Reservation of Land and Water Areas for Port Use (All Ports)*

Significant problems are reported in the process of reserving land for future port uses. Existing master-plans are constrained by apparently uncoordinated adjacent developments and land occupancy. It is considered important that these processes are reviewed in parallel with audits of the master-plans for each of the ports of national importance (W14, 26, 41, 47). These master-plan audits would confirm the future land requirements for each of the ports. The Ministry of Transport, Information Technology and Communications should have a say in the assignment of leases and possession of land which is strategically significant to the development of the ports and their associated infrastructure.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.3 *W04 – Management of Concession Procedures*

Changes in the laws would help to ensure that the management of concession award processes and their ongoing management are carried out by the appropriate government agency. Concessions are considered to be potentially of significant value in accelerating the rate of investment in port infrastructure and the concession processes need to be streamlined.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.4 *W05 – Port Efficiency Improvements (All Ports)*

An audit would assist in identifying the causes of slow vessel service times. These are likely to be due to a range of causes, some related to port infrastructure – berth availability, equipment condition and availability, cargo handling methods etc – and some related to procedures for processing vessels and cargo. Once quantified and prioritised, corrective measures need to be developed and implemented. In the case of infrastructure improvements, identified corrective measures will feed into the master-plan review process (W14, 26, 41, 47). Such a review would be important in helping to lift vessel service times to European standards.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.5 *W06 – Improved Efficiency in Terminal Maintenance Procedures*

The port operating companies have reported significant problems with the funding and resourcing for repairs and maintenance of terminal infrastructure. This is reflected in the generally poor condition of much of the country's port infrastructure. There is a need for a review of the respective repair and maintenance responsibilities of the port infrastructure companies and the port operating companies, and appropriate procedures for its funding and execution. This is particularly important in the case of terminals being offered for operating concession. Improvement in maintenance procedures is considered an essential element in maximising terminal capacity and efficiency.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.6 *W07 – Improved Efficiency in Terminal Equipment Procurement*

The port operating companies report extreme difficulties in the procurement of terminal equipment due to over-regulation. Approval to purchase equipment is reported to take up to 2 years, followed by protracted and heavily regulated procurement procedures which take significant additional time and put at risk the ability of the port operating company to maintain a degree of uniformity in the resulting equipment types and manufacture. This complicates subsequent equipment maintenance and the required inventory of spare parts. The ability to procure terminal equipment without such difficulties will speed up modernisation of the terminals.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.7 *W08/W12a – Receival of Liquid and Hard Wastes*

This option includes the preparation of waste management plans for all ports, development of a database for wastes from ships, construction of receptacles and treatment facilities at Varna, Burgas and Lom, and introduction of environmental management and control systems. It is potentially an important element in achieving compliance with international environmental standards.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.8 *W09 – Establishment of a National Ports Association*

A need has been expressed for the creation of a national ports association, which would promote co-operation between ports at both technical and commercial levels. Forms of membership would be available to port owners, port operators and port user groups. Links would be established with other national port associations and international bodies such as the International Association of Ports and Harbours (IAPH) and the Permanent International Association of Navigation Congresses (PIANC). The Executive Agency for Maritime Administration considers that technical and commercial co-operation is adequately covered by existing organisations within the ports sector.

Recommendation – not carried forward in to the Master Plan

8.5.9 *W10 – Vessel Traffic Management Information System*

This system is considered to be essential to overall navigation management and to meet European operational standards. The basic system has already been established through Phases 1 and 2 under the PHARE programme. The third phase involves further development of the system, coverage of the Bulgarian Black Sea region and increasing the scope of services to shipping.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.10 *W11 – Improvements in Danube River Navigation*

The navigation channel does not comply with the internationally accepted design standards issued by the Danube Commission. There are depth restrictions at two locations and sections of the river bank, guide walls and bottom sills require stabilisation and repair. This option is needed to comply with the Danube Commission navigational standards, in improving navigational safety, and in increasing the operational efficiency and capacity of the river system.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.11 *W12 – Information System for the River Danube*

Navigation hazards on the River Danube include swift changes in water depths, channel obstructions, stranded vessels, ice drift and fog. A river information system will collect all relevant physical data and provide necessary information to vessels before commencement of, and during, river transits. This is considered to be essential in providing navigation safety in line with European standards.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.12 *W13 – Danube River Winter Shelter*

This option provides for completion of a winter shelter for 39 vessels in the River Danube. It is considered to be a priority in improving the efficiency and safety of river navigation.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.5.13 *W14/W26/W41/W49 - Port Master Plans and Port Specific Interventions*

The long list of options also contains a large number of proposals for specific investments at particular ports. Some of these options are dependent on other options being implemented, such as the provision of increased depth or the relocation of other facilities. It is considered preferable that these individual investment proposals are remitted for consideration as part of the development of updated overall master plans for each port.

The master-plans for the Ports of Varna, Burgas, Lom and Ruse need to be reviewed from a number of perspectives:

- the latest regional trade forecasts;
- rationalisation of the number of ports and terminals required to service the forecast trade;
- specialisation of terminal types where justified by throughput;
- grouping of compatible trade types where appropriate to multi-purpose terminals;
- removal or mitigation of urban conflicts and environmental impacts;
- definition of land requirements for future development;
- identification of opportunities for terminal concessions;
- identification of necessary investments in seed infrastructure (dredging, reclamation, utilities headworks, road and rail links, bridge modifications, intermodal facilities etc) to stimulate interest from the private sector; and
- formulation of overall development strategy.

There would also be a benefit in extending the briefs for the Master Plan reviews to examine the opportunities and potential economic development gains from creating the ports as business hubs with encouragement for associated and ancillary businesses to set up operations in close proximity to the ports themselves.

The specific initiatives within each of the four ports to be incorporated in to the Master Plan reviews are described below.

8.5.13.1 *W14/W15/W16/W17/W18/W19/W20/W21/W22/W24/W24a/W24b/W25 – Port Varna Review of Master Plan and Development Strategy*

The specific proposals to be considered as part of the overall Master Plan and development strategy review include:

- Separation of the port into three parts, (Balchik, Varna East and Varna West) to stimulate competition and open the ports up to concessions. (W15)
- Varna West capacity improvements - deepening alongside the berths and in the approach channels, rehabilitation of berths and modernisation of equipment. (W16)
- Varna West hazardous cargo terminal - construction of a 1.2mtpa hazardous cargoes terminal. (W17)
- Improved access to Varna Lake – feasibility study into easing restrictions on air draft of vessels under Varna road bridge and channel depth limitations. (W18)
- Varna Lake grain terminal - construction of a 1mtpa grain terminal in Varna Lake. (W19)
- Varna deepwater berth - provision of a new deepwater berth to the east of Varna Road Bridge. Without the limited air draft and channel draft imposed by the bridge a 300m berth could be constructed which could accommodate large container vessels, with transhipment to other Black Sea ports, and large passenger ships. (W20)
- Varna East Ro/Ro, ferry and passenger terminal and business centre - redevelopment of the eastern end of Varna East. (W21)
- Varna intermodal terminal – a new terminal to provide for the efficient transfer of unitised freight for onward movement by rail from the port. (W22)
- Varna West container terminal expansion - modernisation and expansion of the existing container terminal to a capacity of 100,000TEU. (W24)
- Varna Fuel Terminal - development of a 2mtpa bulk fuels terminal in Konstantinovo on the south shore of Varna Lake. (W24a)
- Varna Logistics Centre - attached to the proposed passenger terminal at Varna East. (W24b)

- Lesport grain terminal - development of a multi-purpose terminal suitable principally for grain and liquid cargo. (W25)

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.5.13.2 *W26/W27/W28/W30/W31/W32/W33/W34/W35/W36/W37/W38/W39/W40 - Port Burgas Review of Master Plan and Development Strategy*

The specific proposals to be considered as part of the overall Master Plan and development strategy review include:

- Separation of the port into to four parts (Burgas East, Burgas West, Rosenets and Nesebar) to stimulate competition and open the ports up to concessions. (W27)
- Burgas Terminal East - closure of existing operations and relocation of the existing trades to other terminals to reduce urban conflict and environmental impact. (W28)
- Burgas Terminal 1 bulk liquids terminal - development of a bulk liquids terminal for crude oil, liquid chemicals, alcohol, wine, distillates and general cargo. (W30)
- Burgas Terminal 2B general cargo terminal - a new 1.4mtpa terminal for cast iron ingots and general cargo. (W31)
- Burgas crude oil terminal - development of a new 30-35mtpa crude oil terminal by expanding Rosenets liquid cargo facility or by installation of a single point tanker mooring. This prospect is linked to the proposed Burgas-Alexandruopolis pipeline. (W32)
- Rosenets crude oil terminal – expansion and reconstruction of the crude oil port. (W33)
- Burgas LNG terminal – development of a new liquefied natural gas terminal. (W34)
- Rosenets channel improvements - dredging of the approach channel. (W35)
- Burgas Terminal 3 – development of a new ro/ro and ferry terminal. (W36)
- Burgas passenger terminal - the development of a combined public transport interchange which links ferry, rail and bus passengers. The development is planned to be located at Terminal East following the relocation of existing trade to other terminals. (W37)
- Burgas intermodal terminal – a new terminal to provide for the efficient transfer of unitised freight for onward movement by rail from the port. (W38)
- Burgas terminal capacity improvements - the upgrading of the power supply to the port and its reticulation to the various terminals. (W39)
- Nesebar, Sozopol, Pomorie, Tsarevo, Ahtopol – closure of ports and relocation of trades to alternative terminals. This is aimed at eliminating urban conflict and operational impact, rationalising the provision of port infrastructure and optimising public access. (W40)

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.5.13.3 *W41/W42/W43/W44/W45/W46 - Port Lom Review of Master Plan and Development Strategy*

The specific proposals to be considered as part of the overall Master Plan and development strategy review include:

- Separation of the port into to three parts (Lom, Oryahovo and Vidin) to stimulate competition and open the ports up to concessions. (W42)
- Lom multi-purpose terminal - development of a 1mtpa general cargo terminal with an additional capacity of 100,000TEU. (W43)
- Lom equipment improvements - modernisation of the port's cranes and crane support structures. (W44)
- Lom capacity improvements - rehabilitation of the port's berths and pavements. (W45)
- Lom intermodal terminal - a new terminal to provide for the efficient transfer of unitised freight for onward movement by rail from the port. (W46)

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.5.13.4 *W47/W48/W49/W50/W51/W52/W54 - Port Ruse Review of Master Plan and Development Strategy*

The specific proposals to be considered as part of the overall Master Plan and development strategy review include:

- Separation of the port into to six parts (Ruse East, Ruse West, Svishtov, Somovit, Silistra and Tutrakan) to stimulate competition and open the ports up to concessions. (W48)

- Ruse grain terminal - development of a new grain terminal in Ruse East. Development is proposed in two stages, being 40,000t and 30,000t respectively. (W49)
- Ruse capacity improvements - development of additional open storage areas at Ruse in order to increase capacity and cargo handling efficiency. (W50)
- Ruse equipment improvements - provision of larger capacity cranes for Ruse, Somovit and Tutrakan. (W51)
- Ruse Centre passenger terminal - the development of a passenger terminal to accommodate up to 300,000 passengers per year, together with a recreation zone. (W52)
- Silistra Ro/Ro terminal – development of a 200,000 unit per year ro/ro terminal. (W54)

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.5.14 *W53 – Ruse Inter-Modal Terminal*

This option was considered with other inter-modal schemes in Section 8.7.

8.6 Air Transport Options

8.6.1 *A01 Airport Charges*

Airport charges in Bulgaria are set by the Council of Ministers. There are four separate components as follows:

- Landing charge;
- Parking charges;
- Passenger loading bridge usage charge; and
- Passenger service charge.

The charging structure in place at Bulgarian Airports, whilst simple, is somewhat inflexible. Primary charges are a simple product of aircraft size and passenger numbers. There is no ability to price in a relationship to the noise and/or emissions performance of aircraft and there is no real ability to introduce seasonal variations in prices or variations in prices at different facilities (terminals) to reflect differing levels of service.

The option is to consider a different arrangement for the setting of airport charges in Bulgaria which has the potential to lead to a stimulation of the markets at the regional airports when they are not well utilised and will increase the chances of low cost carriers initiating new routes at some of these airports. This change could lead to a more efficient use of airport infrastructure and also lead to an improvement in the environmental performance of the various airports by encouraging quieter/less polluting aircraft.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.6.2 *A02/A04/A05/A10/A11/A12/A13/A14 - Air Market Study (Central and Northern Bulgaria)*

There are two non-operational airports in north central Bulgaria (Ruse and Turgovishte) as well as the operational airport at Gorna Oryahovitsa. These three airports are in reasonable geographic proximity to each other, although poor surface transport links in this part of Bulgaria mean that journeys times to these airports may be long.

Currently there are no passenger services operating at Gorna Oryahovitsa Airport. A concession for Gorna Oryahovitsa airport has been considered but has not been progressed. A concession for Ruse Airport has been advertised a number of times but has been unsuccessful. This would suggest that given current population levels in this part of Bulgaria and the current economic climate, demand for business and leisure air travel in northern and central Bulgaria is relatively low. However, this is an unknown, as is the future demand for business and leisure air travel in northern and central Bulgaria.

Given that there are a number of airports in reasonably close proximity in an area of relatively low population density it would be appropriate to carry out an air market study which would assess current as well as future potential demands. The study would also consider the assessed demands in terms of airport strategy for the area and recommend whether or not there is potential for one or more of these airports to support passenger services. The study would bring together a number of options from the long list all related to operations and investment at the central Bulgarian Airports.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan as a combined scheme

8.6.3 *A03 - Security Operations*

Various parties provide security services at Bulgarian airports. There is an opportunity to review responsibilities and to rationalise the way that security is operated. This has the potential to lead to improvements in operational efficiency and in security standards by ensuring that ownership and responsibilities are clear.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.6.4 *A7 - Plovdiv Airport (full or part concession)*

This option is not likely in the short to medium term given that the Bulgarian Government has invested significant sums of money in to a new terminal building and associated facilities at the airport. This might be an option to be considered at some point in the longer term once the market at the Airport has become more well-established and viable and when further investment in new facilities is required.

Recommendation – not carried forward in to the Master Plan

8.6.5 *A8 - Plovdiv, Varna and Burgas Airports Route development/marketing study*

A common characteristic at all of these airports is the highly seasonal nature of traffic with high summer peaks at Varna and Burgas Airports and a high winter peak at Plovdiv Airport. This means that during the winter at Varna and Burgas Airports and the summer at Plovdiv Airport there is significant un-used airport capacity meaning that overall asset efficiency is relatively low.

A route development/marketing study would provide a view on the potential of these airports to sustain year-round services through detailed discussions with a variety of airlines. This would build on the current work by the concessionaire at Varna and Burgas Airports and the initial route development work carried out by an independent consultant at Plovdiv Airport. The study would also explore the mechanisms that could be used to stimulate passenger growth and new airline frequencies and services.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.6.6 *A9 - Sofia Airport Capacity Development*

With the continuing economic growth and development of Bulgaria at some point in the medium term additional capacity will be required at Sofia Airport. There is spare capacity within the existing terminal buildings and the runway but as demand grows there will be a need to provide more. Terminal capacity is likely to run out before runway capacity. Whilst adding capacity at Sofia Airport would contribute little to the evaluation criteria focussed on regional development, capacity enhancement at the capital city airport when required will contribute to broader national and international cohesion objectives.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.6.7 *A11 - Stara Zagora Airport Full or Part Concession*

Stara Zagora Airport is relatively close to the fully operational and newly improved Plovdiv Airport. There is an excellent and direct 60 minute road connection via the Trakia highway and both Plovdiv and Stara are on the important west to east railway line from Sofia to Burgas.

The potential for any significant passenger or freight air movements must therefore be very limited and would be better and more efficiently concentrated at Plovdiv to make the most of the new investment there.

Recommendation – not carried forward in to the Master Plan

8.6.8 *A15 - Stara Zagora Investment/Refurbishment*

Although investment and development at Stara Zagora Airport is likely to produce benefits when considered against social criteria, the economics of the required investment at Stara Zagora Airport are unlikely to warrant this option becoming a key strategic part of the General Transport Master Plan for Bulgaria.

Recommendation – not carried forward in to the Master Plan

8.7 Inter-Modal Options

8.7.1 *IM01 - Plovdiv Intermodal Terminal*

A new intermodal terminal to link rail and road freight transport close to Plovdiv will serve the major industrial and business activities in the south central part of the country. Because of its close connections to international road and rail links it will have the potential to promote conditions for the optimal combination and integration of the two transport modes and provide a higher quality, more efficient and more economic freight transport service.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.7.2 *IM02 - Ruse Intermodal Terminal*

A new intermodal terminal to link rail, road and water-borne freight transport close to Ruse will serve the major industrial and business activities in the north central part of the country. Also because of its close connections to international road, rail and water connections it will have the potential to promote conditions for the optimal combination and integration of the two transport modes and provide a higher quality, more efficient and more economic freight transport service. It is also likely to promote additional trade on the Danube River, through the port of Ruse and between Bulgaria and Romania.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.7.3 *IM03 - Public Transport Interchange Technical Study*

There is undoubted potential for improved interchange between public transport modes at major transport hubs in Bulgaria to have a positive and beneficial effect on the service offered to travellers.

The locations for improvement and the types of intervention can only be determined by a technical study which could be based on the new transport data and information gathered for General Transport Master Plan.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.7.4 *IM04 - Port/Rail Interchange Technical Study*

Evidence from discussions with port and rail operators indicates that one of the constraints for the expansion of intermodal trade through the major ports on the Black Sea and River Danube is the absence or poor quality of interchange facilities. Removing these constraints and investing in modern interchange equipment and facilities will help the ports on both the Black Sea and Danube become more efficient and more competitive.

The locations for improvement and the types of intervention can only be determined by a technical study which could be based on the new transport data and information gathered for General Transport Master Plan.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.7.5 *IM05 - Intermodal Rail Rolling Stock Technical Study*

Evidence from discussions with rail operators indicates that one of the constraints for the expansion of intermodal trade through Bulgaria is the very limited availability and poor quality of dedicated intermodal rolling stock suitable for the carriage of containers and lorry trailers.

The type of equipment and numbers required can only be determined by a technical study which could be based on the new transport data and information gathered for the General Transport Master Plan.

Recommendation – carried forward from the long list for consideration of inclusion in the Master Plan

8.8 Schemes Recommended to be Taken Forward

Table 8.1 lists all the options recommended for consideration of inclusion in the Master Plan following the initial and detailed appraisal process, divided into the categories of Management and Administration, Corridor Strategies and Network Strategies.

Table 8.1 - Options Recommended for Master Plan Consideration

Option No.	Option Title	Option Type		
		Management and Administration	Corridor Strategies	Network Strategies
Highways				
H01	Roads Infrastructure Administration and Network Hierarchy	X		
H02	Funding and Charging	X		
H03 & H04	Network Maintenance Plan and Network Asset Condition Monitoring			X
H05	Development of a Road Safety Information and Education Campaign			X
H06	Driver Information Systems			X

Option No.	Option Title	Option Type		
		Management and Administration	Corridor Strategies	Network Strategies
H07	Review of Academic and Professional Training and Research Institutes	X		
H08	A1"Trakia" Motorway Stara Zagora to Karnobat		X	
H10	A2"Hemus" Motorway Sofia ring Road to Yana		X	
H11	A2 "Hemus " Motorway Yablanitsa to Shumen		X	
H12	A3 "Maritsa" Motorway		X	
H13	A4 "Black Sea" Motorway		X	
H14	A6 "Struma" Motorway		X	
H15	Sofia Ring Road Northern Arc		X	
H16	Sofia Ring Road Southern Arc		X	
H17	Rila Highway		X	
H19	Botevgrad to Mezdra, Vratsa Bypass, Montana Bypass, Ruzhintsi to Dimovo		X	
H23a	Ruse to Makaza via V. Tarnovo, Shipka Pass, Stara Zagora and Dimitrovgrad		X	
H23b	Ruse to Makaza via V. Tarnovo, Pass of the Republic, Nova Zagora and Dimitrovgrad		X	
Railways				
R01	Railway Administration	X		
R02	Funding and Charging	X		
R03	Network, Station and Freight Facilities Rationalisation			X
R05	Asset and Information Management/ Network Maintenance Plan			X
R07	Speed enhancements			X
R08	Passenger Facilities			X
R09	Passenger Information			X
R10	Training and Education	X		
R11	Locomotives and Rolling Stock			X
R12	Vidin to Sofia		X	
R13	Sofia to Plovdiv to Burgas		X	
R14	Sofia – Pernik – Radomir to Blagoevgrad to Kulata (Greek border)		X	
R21	Sofia to Mezdra to Gorna Oryahovitsa to Varna		X	
R23	Ruse to Gorna Oryahovitsa to Stara Zagora		X	
Water Transport				
W00	Port operational assessments and certification			X
W03	Reservation of land and water areas for port use (all ports)	Admin process component		X
W04	Management of concession procedures (all ports)	X		
W05	Port efficiency improvements (all ports)			X
W06	Improved efficiency in terminal maintenance procedures	Admin process component		X

Option No.	Option Title	Option Type		
		Management and Administration	Corridor Strategies	Network Strategies
W07	Improved efficiency in terminal equipment procurement	X		
W08	Receival of liquid and hard wastes			X
W10	Vessel traffic management information system			X
W11	Improvements in Danube Navigation		X	
W12	Information System for the Danube River		X	
W13	Danube River winter shelter – Phase 3		X	
W14	Port Varna – review of master-plans and development strategy		X	
W26	Port Burgas – review of master-plans and development strategy		X	
W41	Port Lom - review of master-plans and development strategy		X	
W47	Port Ruse - review of master-plans and development strategy		X	
Air Transport				
A01	Airport Charges	X		
A02	Air Market Study (Central and Northern Bulgaria)			X
A03	Security Operations			X
A08	Plovdiv, Varna & Burgas Airports – Route Development Study			X
A09	Sofia Airport		X	
Inter-Modal Transport				
IM01	Plovdiv Inter-Modal Terminal		X	
IM02	Ruse Inter-Modal Terminal		X	
IM03	Public Transport Interchange			X
IM04	Port/Rail Interchange			X
IM05	Inter-Modal Rail Rolling Stock			X

9 The Master Plan Strategy

9 The Master Plan Strategy

9.1 Introduction

Building on the analysis presented in Chapter 8 this Chapter sets out the proposed overall Master Plan Strategy and identifies priority projects which should be considered for early implementation. It considers how the Master Plan can support the policy objectives through a well managed network, in good condition, where the different modes work together to deliver the capability and capacity to meet Bulgaria's future needs.

As first referenced in Section 6.2.2 we make a distinction between the different types of project or intervention.

The three categories are:

- **Management and Administration** – these relate to the ways in which transport is planned for, is funded and is administered;
- **Corridor Strategies** – in bringing together the Master Plan it is important to examine the most appropriate major new physical infrastructure projects within the context of the main transport corridors and nodes rather than by individual transport modes. The corridors examined are based on the Trans-European Network (TEN) with the addition of non-TEN corridors of strategic national importance to Bulgaria; and
- **Network Strategies** - these are interventions that are related to the transport networks and the services on them but which do not rely on major new physical infrastructure projects.

9.2 Master Plan Development Process

9.2.1 Combination of Options

The overall aim of the study has been to develop a coherent and prioritised strategy for the development of Bulgaria's transport system to meet the country's future economic and transport needs. It is more than simply a list of schemes that are justified in themselves. To be included in the ultimate strategy, options need to contribute to the overall objectives of the study and to be consistent with other options. In some cases it is clear that schemes taken forward from the appraisal process complete with one another and only one alternative will be taken forward. In such a situation additional tests were required to identify the level of competitiveness.

Conversely, some options have the potential to work together to increase benefits. For example, in the rail sector, the combination of new trains and improved infrastructure may create greater benefits than simply the sum of these two separate interventions. In relation to the management and regulation options, it is important to ensure that they are consistent with each other and create a consistent and robust policy framework that can be expected to last for an extended period.

It is also important to understand that improvements in one mode of transport may have a negative or a beneficial effect on other modes.

9.2.2 Evaluation of Master Plan Performance

The final stage of the Master Plan development process was to evaluate the overall performance of the Master Plan Strategy. This demonstrated the validity of the strategy in economic, social policy and environmental terms. It shows how it would be consistent with the National Strategic Reference Framework and with EU transport policy. This will provide the basis for its subsequent approval by the Bulgarian Government and the EU, as the basis for funding the investments that it recommends.

It is important that the strategy is not only justified in relation to the key assumptions that form our central case scenario in relation to factors such as economic growth. It also needs to be robust if the outturn situation is significantly different. Accordingly sensitivity tests were concluded to assess the robustness of the overall strategy.

9.2.3 Priority Projects

It is likely that the funding requirements for the overall Master Plan strategy will substantially exceed the funding that can be allocated to the transport sector.

If this is correct, it will be an important outcome of the study. It will be very valuable in demonstrating the economic, social and environmental benefits of greater investment in transport in the future. However, the Master Plan will also need to make a realistic appraisal of what can be achieved with the sources of funding available in the period to 2015. These will include:

- Cohesion and ERDF funding and national co-financing;
- Loans from the EIB and other International Financial Institutions;
- PPP projects;
- Other projects where there is a stream of revenue or cost savings that can fund the required investment; and
- Miscellaneous sources such as sale of surplus transport land holdings.

To the extent that opportunities result from improved management of the transport network, rather than infrastructure investment, the investment required may be relatively low and this suggests that these projects could be implemented early.

Clearly not all the funding sources are fixed – if a large number of potential PPP projects are identified, the opportunity for funding from this source will grow. However, this needs to be considered alongside the risk of delay due to the greater complexity of PPP projects. This is less of an issue for pure PPP projects, where the EU funding deadline will not apply, but could be a significant issue if projects are planned to include a combination of EU and private finance. The issue of funding is described further in Chapter 10.

A second major constraint on the implementation of the strategy will be the industrial and institutional capacity to implement it. It is critical to understand this constraint so that measures can be taken to overcome it. A balance will have to be established between the need to maximise the Bulgarian content of the investment to strengthen growth and the enhancement of human skills and the need to ensure that the available EU funding is drawn down by the 2015 deadline for expenditure in the current OPT.

The third issue to be considered is the inherent complexity of the projects included in the overall Master Plan Strategy and their current state of readiness. It may be preferable to delay the implementation of the most complex projects until after 2015, if earlier implementation is likely to create risks to the drawdown of funding.

9.3 Management and Administration Options

This section focuses on those options which relate to the management and administration of the transport system aimed at improving management of the existing transport system and the efficient implementation of investment projects. They are designed to ensure that Bulgaria obtains good value from resources that are allocated to the transport sector.

The options considered in this chapter are set out in **Table 9.1.**

Table 9.1 - Management and Administration Options

Option No	Option Title
H01	Review of Roads Infrastructure Administration and Network Hierarchy
H02	Review of Highway Funding and Charging
H07	Review of Academic and Professional Training and the Role of Research Institutions
R01	Railway Administration
R02	Review of Railway Funding and Charging
R10	Training and Education
W04	Management of Port Concession Procedures
W07	Improved Efficiency in Terminal Equipment Procurement
A01	Airport Charging

These options can logically be divided into three categories:

- Improved Administration (H01, R01, W04, W07);
- Funding and Charging (H02, R02, A01); and

- Training and Education (H07, R10).

They are considered under these headings below.

9.3.1 *Improved Administration*

Option H01 "Roads Infrastructure Administration and Network Hierarchy" aims to improve the delivery of investment projects and to ensure that maintenance expenditure is focused on sections of the network where it is most needed. In order to assist in achieving this, Option H01 proposes a review of the structure and responsibilities of the Road Infrastructure Agency and how its work relates to both the Ministry of Transport, Communications and Information Technology and the Ministry of Regional Development and Public Works. Key issues to be addressed in the review include:

- The most efficient structure for the delivery of major strategic investment projects of national economic significance;
- The current classification of the road network, which may not be fully in line with the current usage and strategic role of sections of the network; and
- The approach to ensuring the prioritisation of maintenance activities where they are most needed.

Following the collapse of the concession for the extension of the Trakia motorway, it will also be important to consider the future role of the private sector in the provision of road infrastructure in Bulgaria.

Option R01 "Railway Administration" involves a broadly similar review of the organisation of the rail industry. However, the situation is more complex in rail because of the greater technical complexity of the infrastructure, the need for greater co-ordination between infrastructure providers and operators because of the operational characteristics of rail and the fact that the largest operator is state-owned. As in the case of the ARI, the organisational structure of the National Rail Infrastructure Company (NRIC) will need to be reviewed, to examine whether it is also appropriate for the company's role in the maintenance and enhancement of rail infrastructure.

A similar review of the structure of BDZ is also needed. An important issue will be to ensure that the passenger and freight businesses of BDZ are appropriately structured to meet the needs of their respective customers. The potential for increasing the role of the private sector in the provision of infrastructure and railway services needs to be examined.

Bulgaria's port sector has shown limited adaptability to changes in market demand, partly due to the limited development of concessions for port terminals. An important issue is to develop efficient procedures for the letting of concessions and the definition of the roles of the different agencies involved including:

- National government – overall ports policy and regulation;
- Port authorities – port master planning and the provision or regulation of common services such as dredging, navigation aids and pilotage; and
- Terminal operators – investment in and operation of terminals.

An important issue for Bulgaria is to define which functions should be undertaken by public agencies and which by the private sector, and then to develop efficient procedures for involving private investors. This is the aim of Option W04 "Management of Concession Procedures (all ports)".

To the extent that this results in private operation, the concessionaire would typically be expected to take over responsibility for terminal equipment procurement, addressing Option W07 "Improved Efficiency in Terminal Equipment Procurement". However, in some cases, it may be appropriate for publicly owned port authorities to purchase equipment directly. In this situation, it will be important to create a position where port authorities have the budget and authority to purchase equipment directly to meet their needs.

The common theme of all these options is the need to review organisational structures to improve their efficiency to deliver an improved transport network that meets Bulgaria's needs. A key element of this is the ability of the agencies to absorb the funding available through the EU's Cohesion and Regional Development Funds. A second important issue is to define the role that Bulgaria expects the private sector to play in the future provision of transport infrastructure. While the circumstances of each mode vary, and therefore the solutions adopted may differ, it is important to provide a clear, consistent overall policy direction.

9.3.2 *Funding and Charging*

A key issue for governments throughout Europe is the development of effective and economically efficient mechanisms to charge for transport use. Typically governments have sought to address two issues:

- The need to obtain income to fund investment in transport infrastructure and services; and
- The desirability of internalising the external costs of the transport system, for example air pollution and noise, to influence the behaviour of travellers and transport operators.

Options H02 "Review of Highway Funding and Charging", R02 "Review of Railway Funding and Charging" and A01 "Airport Charges" are all focused on addressing these issues.

The EU has allocated €2 billion to Bulgaria for transport investment under the Operational Programme for Transport 2007-2013 and substantial further investment can be expected under future Operational Programmes. However, this is unlikely to be sufficient to meet the transport needs of Bulgaria. Accordingly there is a need to look for other sources of funding. Despite the collapse of the Trakia concession, the role of tolls needs further consideration, important advantages of toll systems include the opportunity to charge transit traffic directly for the costs that it imposes on the network and the opportunity to use tolls to encourage transfer to environmentally sustainable modes of transport, especially rail and water transport.

If such transfer is to be achieved in practice, investment in the rail and waterway modes will be required. While EU support will be very important it is also essential to ensure that the structure of rail charges promotes economically and environmentally efficient outcomes. In this context it is important to review the structure of rail access charges to ensure that they relate to the cost imposed including infrastructure impact, costs of operation and inspection, terminal costs, energy use and (as demand rises) rationing of source capacity. This will allow users to make a contribution to meeting investment costs while encouraging rail use. It will also provide a basis to allow NRIC to borrow to fund investment.

Currently rail passenger fares are very low by European standards, in part reflecting the relatively low quality of service offered. While it could be counter-productive to seek to raise fares in advance of quality improvements, and whilst there may be social policy reasons to hold down short distance rail fares, it would be reasonable to expect medium and long distance fares to rise as the quality of service improves.

In the aviation sector, airport charges are set centrally by government with limited flexibility. This may result in outcomes which do not optimise the environmental and economic efficiency of the airport sector. This is particularly important for Bulgaria given that all the main airports, apart from Sofia, have highly seasonal patterns of use. Greater flexibility in setting charges could encourage greater use of Varna and Burgas airports in winter and Plovdiv airport in summer. Relating charges to environmental impact could encourage the use of quieter, more fuel efficient aircraft types. While government has an important interest in regulating the overall level of airport charges to meet national economic requirements, greater flexibility would be highly desirable.

9.3.3 *Education and Training*

Options H07 "Review of Academic and Professional Training and the Role of Research Institutes" and R10 "Training and Education" are both concerned with ensuring that Bulgaria's education system and the training provided within the transport sector meet the future needs of the country.

Bulgaria's education system has an excellent reputation, with very high levels of literacy and technical education. However it is important to ensure that this is focussed on providing the precise skills that will be needed to meet the country's development. In particular there is a lack of expertise in transport planning and investment appraisal. This may result in sub-optimal projects being developed. This has the double disadvantage that Bulgaria could lose investment to better prepared projects in other countries and that those projects that are implemented may not deliver the expected benefits. It is also important that the education system develops technical specialists with the skills to make best use of new technologies and managers with the breadth of vision to take the review forward.

Research institutes and universities have a key role to play in developing ideas and disseminating international best practice. It is therefore important that they are adequately funded to fulfil this role. This is potentially an area for joint action between the Operational Programme on Transport and the Operational Programme for Human Resources. This theme is developed further in Section 10.4.

9.4 **Corridor Strategy Options**

This section focuses on the most appropriate major new physical infrastructure projects within the context of the main transport corridors and nodes rather than by individual transport modes. This helps to ensure

that there is complementarity rather than competition between options for different transport modes that potentially serve the same market.

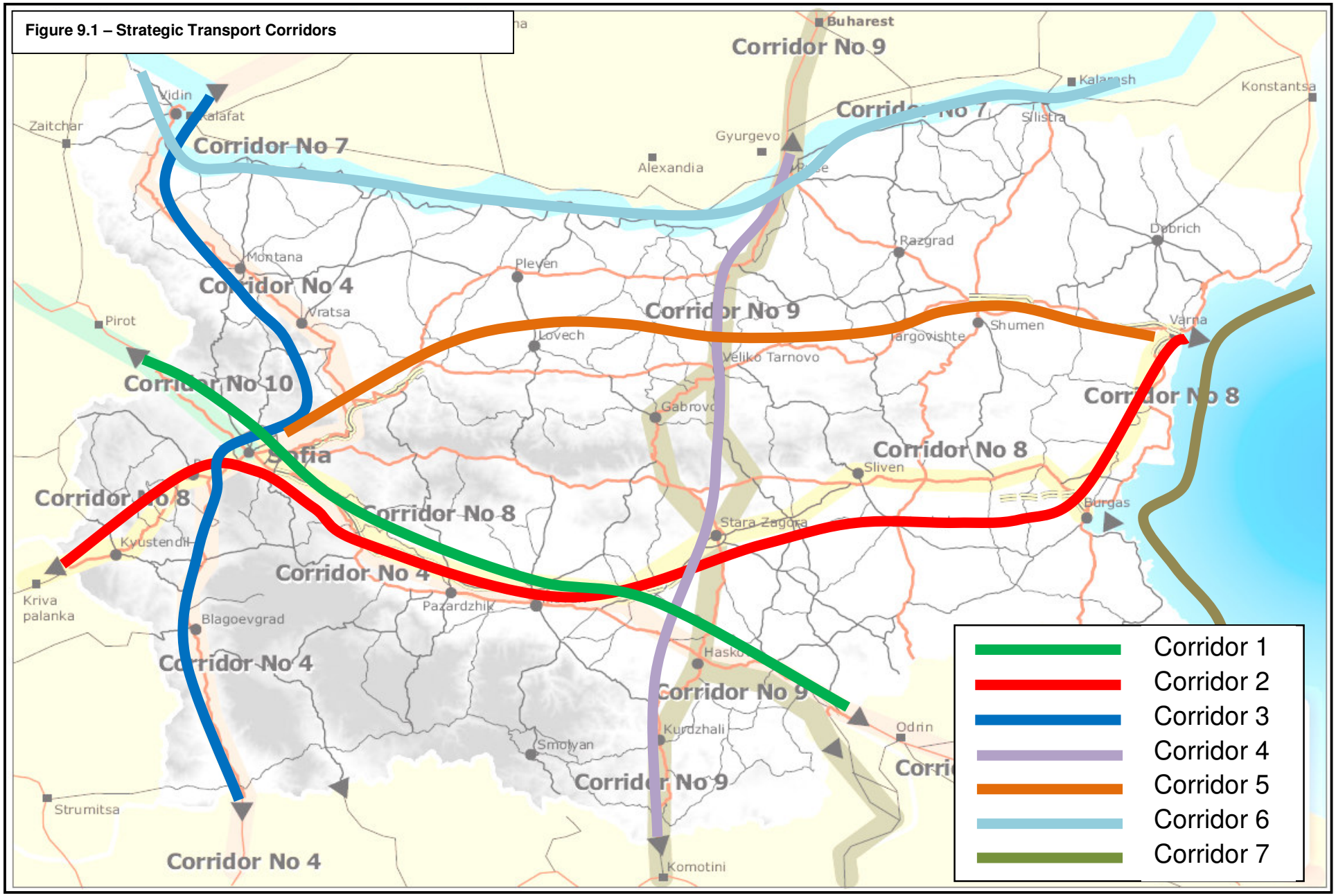
The options considered are shown below in **Table 9.2**.

Table 9.2 - Corridor Strategy Options

Option No	Option Title
H08	A1 Trakia Highway (Stara Zagora to Karnobat)
H10	A2 Hemus Highway Sofia Ring Road to Yana
H11	A2 Hemus Highway Yablanitsa to Shumen
H12	A3 Maritsa Highway (Chirpan to Harmanli)
H13	A4 Black Sea Highway (Burgas to Varna)
H14	A6 Struma Highway (Dupnitsa to Kulata)
H15	Sofia Ring Road Northern Arc
H16	Sofia Ring Road Southern Arc
H17	Rila Highway (Dupnitsa to Trakia/Hemus)
H19	Botevgrad to Mezdra, Vratsa Bypass, Montana Bypass, Ruzhintsi to Dimovo
H23b	Ruse to Makaza via Pass of the Republic, Nova Zagora and Dimitrovgrad
R12	Renewal and upgrade Vidin to Mezdra to Sofia
R13	Renewal and upgrade Sofia to Plovdiv to Karnobat to Burgas and Varna
R14	Renewal and upgrade Sofia to Kulata
R21	Renewal and upgrade Sofia to Gorna to Varna
R23	Renewal and upgrade Ruse to Gorna Oryahovitsa to Stara Zagora
W03	Reservation of land and water areas for port use (all ports)
W11	River Danube navigation improvements
W13	Construction of winter shelter for 39 vessels
W14	Port Varna review of master plans and development strategy
W26	Port Burgas review of master plans and development strategy
W41	Port Lom review of master plans and development strategy
W47	Port Ruse review of master plans and development strategy
A09	Sofia Airport terminal and runway capacity improvements
IM01	Plovdiv inter-modal terminal
IM02	Ruse inter-modal terminal

The corridors that have been selected correspond to the major national and international movement axes and are aligned closely with the Pan-European Network Transport (TEN-T) corridors. The corridors are shown schematically in **Figure 9.1**. The corridors generally follow historic European trade routes related to river valleys and mountain passes.

Figure 9.1 – Strategic Transport Corridors



9.4.1 Corridor 1 : Serbia (Kalotina) – Sofia – Plovdiv – Chirpan – Turkey (Svilengrad)

9.4.1.1 Corridor Description

Corridor 1 follows the primary west to east axis through Bulgaria between Serbia and Turkey. It follows the natural route through the mountains that divide Serbia from Bulgaria then the plain to Sofia. Eastwards from Sofia the route follows the valley of the Maritsa River to Turkey.

Important international highway and railway links follow the route which provides the most direct land route from the southern countries of Western Europe, through the Balkan region to Turkey, the Middle East and Asia. The importance of the route is confirmed by its designation as part of four Pan-European Network (TEN-T) corridors; IV, VIII, IX and X:

9.4.1.2 Committed Projects

There is one significant committed project that is underway in the corridor, Plovdiv-Svilengrad Railway Electrification and Upgrading. The project encompasses the reconstruction and partial doubling of approximately 150 km of railway track, construction of a catenary system, traction substations, signalling systems, telecommunications and radio control, as well as structures which will enable the complete doubling of the line in the future.

The total estimated project costs is € 340 million of which € 153 million will be from EU grants (ISPA), € 150 million from Bank credits (EIB) and € 37 million from the State budget.

9.4.1.3 Master Plan Schemes

Three infrastructure schemes are recommended for inclusion in the Master Plan.

H12 – A3 Maritsa Highway (Chirpan to Harmanli) - construction of a new motorway to link with the existing Trakia Highway at the Orizovo road junction to Harmanli where it would connect with the recently constructed motorway to the Turkish Border at Kapitan Andreevo. This construction would provide a continuous high quality motorway standard route from Sofia to Istanbul.

R13 – Railway renewal and upgrade Sofia to Plovdiv – part of a scheme to upgrade track, renew infrastructure systems and introduce higher speed tilting trains from Sofia to Burgas and Varna (see Corridor 2). The option incorporates speed enhancement initiatives within R07 and the renewal of locomotives and rolling stock within R11. This would complement the work currently being undertaken to upgrade track and signalling between Plovdiv and Svilengrad and provide a higher speed route, with better reliability and improved capacity between Sofia and Istanbul.

Other elements of the network strategies such as improved stations, better information and improvements to intermodal interchange would make a further contribution beyond what has been addressed quantitatively. This will apply equally to other recommendations for rail infrastructure projects.

The precise specification for the improvements would be the subject of a detailed planning and design study.

IM01 – Plovdiv inter-modal terminal – the design and construction of a rail and road freight transport interchange at Plovdiv. A tender for a feasibility study, preliminary design, cost-benefit analysis and environmental assessment was launched in May 2009. Delivery though this Master Plan will be dependent on a positive outcome to this study but its inclusion here is an acknowledgment of the importance of investment in inter-modal facilities that encourage greater transport operation efficiency and support more sustainable transport solutions.

9.4.1.4 Gaps

The three infrastructure investment projects together will address key problems and gaps in the transport networks and significantly increase the ability to provide a much improved service. They are focussed on that part of Corridor 1 between Sofia and the Turkish Border close to Svilengrad. They do not include any schemes for either highways or railways between the Serbian Border and Sofia. This is because the transport demands now and as forecast are much lower than for the remainder of the corridor and the current standard of infrastructure is appropriate for those demands. The opening of the Vidin-Calafat Bridge will attract both road and rail traffic away from this Corridor and reduce the importance of the Kalotina border crossing. For these reasons no road or rail schemes are proposed over and above the currently programmed minor improvements between Kalotina and Sofia.

9.4.2 Corridor 2 : Macedonia (Gyueshevo) – Sofia - Plovdiv – Burgas – Varna

9.4.2.1 Corridor Description

Corridor 2 like Corridor 1, with which it shares part of its route, also follows a primary west to east axis through Bulgaria between Macedonia and the Black Sea. The section of the corridor between the Macedonian Border at Gyueshevo and Sofia passes through the mountainous regions of Osogovska Planina and Konyavska. From Sofia eastwards it follows the Maritsa valley to Chirpan and the Thracian Plain to the Black Sea.

Important international highway and railway links follow the route which provides land connections between the south western Balkan countries and the Black Sea ports. The importance of the route is confirmed by its designation as part of two Pan-European Network (TEN-T) corridors, IV and VIII.

The continuing prosperity of the Black Sea ports and support for their vital contribution to national and international trade is dependent to a significant degree on high quality road and rail links in this corridor.

9.4.2.2 Committed Schemes

There is one significant committed project that is underway in the corridor, the Lyulin Highway. This is a new dual two lane motorway connecting the junction of the Struma Highway and the E871/I6 east of Pernik, with the Sofia Ring Road to the west of the city. When complete it will provide an important link along Pan-European Corridors IV and VIII and provide significant relief to Republican Road 6 between Pernik and Sofia and to parts of the western section of Sofia Ring Road.

9.4.2.3 Master Plan Schemes

Four infrastructure schemes are recommended for inclusion in the Master Plan.

H08 – A1 Trakia Highway (Stara Zagora to Karnobat) – construction of a new motorway linking the existing sections of Trakia Highway completing a high standard route throughout between Sofia and the Black Sea at Burgas. This is correctly considered to be Bulgaria's highest priority transport investment project.

H13 – A4 Black Sea Highway (Burgas to Varna) – construction of this new motorway would link the two biggest ports of Bulgaria and, in combination with completion of the Trakia Highway, it would provide a motorway connection between Sofia and Varna, Bulgaria's third largest city.

H17 – Rila Highway (Dupnitsa to Trakia/Hemus) – construction of a new highway that would link the Struma, Trakia and Hemus Motorways around the south east side of Sofia. The highway would serve a number of longer distance routes; Greece and Macedonia to Turkey, the Black Sea, and Romania (via Vidin and Ruse). It would also provide access to the winter holiday resort areas around Samokov from Sofia.

The scheme whilst satisfying some important strategic transport objectives for Bulgaria would in many respects be a duplication of routes around Sofia which currently use the Sofia Ring Road. One of the principal beneficiaries would be the private sector through the improved access provided to the winter resort areas south of Sofia. For this reason it would be most appropriate to offer the new highway as a concession with private financing in return for the concessionaire being allowed to charge tolls for the road's use.

R13 – Railway renewal and upgrade Plovdiv to Burgas and Karnobat to Varna – part of a scheme to upgrade track, renew infrastructure systems and introduce higher speed tilting trains from Sofia to Burgas and Varna (see Corridor 1). The option incorporates speed enhancement initiatives within R07 and the renewal of locomotives and rolling stock within R11. This would complement the proposed improvements between Sofia and Karnobat providing a higher speed route, with better reliability and improved capacity between Sofia and the Black Sea.

9.4.2.4 Gaps

The four infrastructure investment projects together will address key problems and gaps in the transport networks and the ability to provide a much improved service. They are focussed on that part of Corridor 2 between Sofia and the Black Sea. They do not include any schemes for either highways or railways between the Macedonian Border and Sofia. This is because the transport demands now and as forecast are much lower than for the remainder of the corridor and the current standard of infrastructure is appropriate for those demands. For these reasons no road or rail schemes are proposed over and above currently programmed minor improvements.

9.4.3 Corridor 3 : Romania (Vidin) – Mezdra – Sofia – Greece (Kulata)

9.4.3.1 Corridor Description

Corridor 3 follows a primary north to south axis through Bulgaria between western Romania and Greece. The corridor starts in the North at the town of Vidin, a small port on the River Danube; it crosses the Danube Plain and the Balkan Mountains (Stara Planina) before reaching Sofia. South of Sofia the corridor skirts the western side of the Vitosha Mountains and then follows the valley of the Struma River to the Greek border at Kulata.

Important international highway and railway links follow the route which provides land connections between North West Bulgaria, Sofia and Greece. There is currently no direct connection across the River Danube in to Romania but this will be provided on the opening of the Vidin Calafat Bridge.

The importance of the route is confirmed by its designation as part of Pan-European Network (TEN-T) Corridor IV and includes two TEN-T EU Priority Projects:

- Priority Project 7 - (Athens - Sofia – Budapest) Motorway Axis
- Priority Project 22 – (Athens - Sofia – Budapest – Vienna – Prague – Nuremburg) Railway Axis

The corridor has additional significance in that it provides a connection between Western Europe and Greece that runs entirely through EU countries.

Improvements to transport connections in this corridor have the potential to adversely impact upon other important and acknowledged interests. Providing new and improved rail and road links together with a combined rail and road crossing of the River Danube at Vidin could alter the balance of cross continent movements. The natural route for international trade from the Eastern Mediterranean and Middle East may currently be via the Black Sea, the Ports of Burgas and Varna then east-west road and rail links across Bulgaria to Serbia and, Central and Western Europe. Improvements to these north-south links have the potential to encourage trade to transfer to the Aegean and the Port of Thessaloniki which would be a big problem for the Bulgarian Black Sea port operations. To provide a fair balance it is important that investment in north-south transport links through Bulgaria is matched by ease-west improvements.

9.4.3.2 Committed Schemes

There is one significant committed project that is underway in the corridor, Vidin – Calafat Bridge, a combined road and rail bridge over the River Danube. It will provide a second fixed crossing of the River between Bulgaria and Romania (the first being at Ruse) along the line of Pan-European Corridor IV linking Germany with Turkey and Greece. Construction started in 2007 and is due for completion in 2011.

9.4.3.3 Master Plan Schemes

Four infrastructure schemes are recommended for inclusion in the Master Plan.

H19 – Botevgrad to Mezdra, Vratsa Bypass, Montana Bypass, Ruzhintsi to Dimovo – the E79/I1 highway between Vidin and Sofia will become increasingly important as part of a new international connection between Romania and Greece after the opening of the Vidin – Calafat Bridge. The forecast flows however do not justify the construction of a new motorway, only the improvement of the existing route to bring it to a consistent and appropriate standard. North of Montana that standard would be a single carriageway road with improved alignment and cross section. South of Montana, where forecast traffic flows are higher, the standard would be a dual carriageway but not full motorway. It would also include new bypasses for Montana and Vratsa.

R12 – Railway renewal and upgrade Vidin to Mezdra to Sofia – the railway between Vidin and Sofia follows a parallel route to the highway as far as Mezdra. From Mezdra to Sofia the railway diverges from the principal road and instead follows the Iskar Valley and Gorge via Zverino and Svoge. The Master Plan proposal is to upgrade the existing track, renew existing infrastructure systems and so enhance operational performance through reduced journey time and greater reliability. The precise specification for the improvements would be the subject of a detailed planning and design study.

An option to build a new railway line from Mezdra to Sofia via Botevgrad, despite achieving a potential 45 minute journey time improvement was rejected because of the prohibitively high cost.

H14 – A6 Struma Highway (Dolna Dikanya to Kulata) – the Struma Highway South of Sofia has benefited from the recent opening of a new section of motorway between Pernik and Dolna Dikanya. The Master Plan proposes the completion of the motorway to the Greek border to link directly to the Greek Motorway network connections south to Thessaloniki and Athens.

The central section of the route has many topographical and environmental challenges, in particular through the Kresna Gorge. For this reason it is proposed that construction of the motorway would be phased with the Northern sections (Dolna Dikanya to Blagoevgrad) and Southern section (Sandanski to Kulata) completed first and the central section (Blagoevgrad to Sandanski) to follow when the significant engineering and environmental impacts have been overcome or mitigated.

R14 – Railway renewal and upgrade Sofia to Kulata – the railway between Sofia and the Greek Border at Kulata follows a broadly parallel route to the highway. It provides two distinct functions, firstly as a very busy suburban passenger railway between Sofia, Pernik and Radomir and secondly as a strategic international freight route through Bulgaria to Greece. The Master Plan proposal is to significantly enhance both of these functions through track upgrading, renewal of systems infrastructure so resulting in improved operational efficiency, improved reliability and reduced journey times. The precise specification for the improvements would be the subject of a detailed planning and design study.

9.4.3.4 Gaps

The highway improvements in the corridor described above do not provide for any new or improved roads around Sofia. Such improvements are very important in providing continuous and high quality strategic connections between the motorways that feed in to Sofia (Hemus, Trakia, Struma, and Lyulin) so ensuring long distance road traffic does not pass through the capital city itself. Improvements to the Sofia Ring Road are considered separately.

9.4.4 Corridor 4 : Romania (Ruse) – Veliko Tarnovo - Haskovo – Greece (Makaza)

9.4.4.1 Corridor Description

Corridor 4 follows a north to south axis through Bulgaria between central Romania and Greece. The corridor starts in the North at Ruse an important border crossing and port on the River Danube. The corridor crosses the Danube Plain, the Balkan Mountains (Stara Planina) and the Thracian Plain before crossing the eastern fringes of the Rodopi Mountains. The corridor runs south to the Greek border at Makaza Pass.

The E85/I5 highway follows the corridor from Ruse to Makaza. There is also a parallel railway route from Ruse through Veliko Tarnovo, Stara Zagora, Haskovo and Kardzhali, but there is no onward connection across the Greek border.

The importance of the route is confirmed by its designation as part of Pan-European Network (TEN-T) Corridor IX. The corridor has additional significance in that it is one of only a few north-south connections between Northern Europe and Greece and the Aegean Sea.

9.4.4.2 Committed Schemes

There are no committed schemes in Bulgaria in this corridor but the Greek Government is in the process of constructing a new highway between Makaza and Komotini which will provide direct access to the West to East Motorway that tracks the Aegean Coast linking Thessaloniki with Alexandruopolis.

9.4.4.3 Master Plan Schemes

Three infrastructure schemes are recommended for inclusion in the Master Plan.

H23b – Ruse to Makaza via Veliko Tarnovo, Pass of the Republic and Dimitrovgrad – two options for highway improvements in this corridor have been considered. Each had common sections to the north and south but alternatives through the Balkan Mountains, a westerly route via a tunnel under the Shipka Pass and an easterly route through the Pass of the Republic. Each would achieve the same objectives of providing for a higher quality strategic north to south connection by road through the central part of Bulgaria, however, the route through Shipka would require a new tunnel and approach roads which would be very expensive and have significant negative environmental impacts. On the other hand the route through the Pass of the Republic has recently been rehabilitated and widened to 3 lanes.

A cost benefit analysis comparison between the two options showed that whilst the benefits from a Shipka route were marginally higher, the construction costs were very significantly more and therefore the relative value for money as measured by the benefit to cost ratio strongly favoured the Pass of the Republic option. As a result the option for the route through the Shipka Pass has been dropped.

R23 – Renewal and upgrade Ruse to Gorna Oryahovitsa to Stara Zagora - Ruse being the only non-ferry based crossing of the Danube into Romania provides a strategic role for this railway line especially as it also crosses the Balkan Mountain range. The proposed intervention includes track upgrade and re-signalling as well as renewing existing infrastructure systems with the aim of enhancing the overall

operational performance. The precise specification for the improvements would be the subject of a detailed planning and design study.

IM02 – Ruse inter-modal terminal - the design and construction of a water, rail and road freight transport interchange at Ruse. A tender for a feasibility study, preliminary design, cost-benefit analysis and environmental assessment was launched in May 2009. Delivery though this Master Plan will be dependent on a positive outcome to this study but its inclusion here is an acknowledgment of the importance of investment in inter-modal facilities that encourage greater transport operation efficiency and support more sustainable transport solutions. This option is also of significance in the context of improvements in Corridor 6, the Danube River.

9.4.4.4 Gaps

The railway improvements proposed in this corridor do not cover that part of the corridor between Stara Zagora and the Greek Border. Whilst the line does extend south through Dimitrovgrad, Haskovo and Kardzhali to Podkova its function is primarily as a local passenger railway. The line does not extend to the Greek Border and there is no line south of the border in the territory of Greece. Investment in a new rail link in to Greece would be prohibitively expensive and generate very limited demand for passenger or freight traffic. No such scheme is therefore proposed.

9.4.5 Corridor 5 : Sofia - Veliko Tarnovo – Shumen – Varna

9.4.5.1 Corridor Description

Corridor 5 follows a west to east axis and is the shortest route between the Capital and the Northern Black Sea. The highway connections along the corridor cross the Balkan Mountains through the Vitinya Pass and then track along the Danube Plain. The railway connections take an alternative route from Sofia following the Iskar Valley and Gorge before dropping in to the Danube Plain at Mezdra.

Whilst this is an important national corridor linking Sofia and the Northern Black Sea with towns in the Danube Plain and Ruse on the River Danube it is not considered of significant international importance. With the exception of the section of route through the Balkan Mountains which is part of Corridor IV it has no TEN-T designation.

9.4.5.2 Committed Schemes

There are no committed major and strategic transport investment schemes in Bulgaria in this corridor.

9.4.5.3 Master Plan Schemes

Three infrastructure schemes are recommended for inclusion in the Master Plan.

H10 – A2 Hemus Highway Sofia Ring Road to Yana - construction of a new motorway to link Sofia Ring Road with the existing start of the Hemus Highway at Yana. Although only a very short section (8.5km) it is of both strategic and local importance. Strategically it lies on the busiest section of the Hemus Highway and is a vital connection in Corridor 3 (TEN-T Corridor IV). Locally it will provide environmental, social and safety benefits to residential properties and businesses on the existing road where it passes through built-up areas.

H11 – A2 Hemus Highway Yablanitsa to Shumen – construction of a new motorway between Yablanitsa and Shumen in combination with H10 above will provide a completed Hemus Highway from Sofia to the Northern Black Sea via the most direct route. Together with a completed Trakia and Black Sea Motorway it would form a motorway box providing high quality highway linkages between the major towns and cities in Bulgaria.

However, whilst it is a recommendation within the Master Plan its relative importance and priority are affected by a number of significant issues:

- Because it does not form part of the TEN-T it is unlikely to secure any significant European funding;
- The construction costs are very high, in the order of €1.5 billion, which is unlikely to be available through state funding for many years; and
- It's strategic function of providing a motorway link between the capital city and the Northern Black Sea will be provided for with the completion of the Trakia and Black Sea Motorways.

For these reasons it would be most appropriate to offer the new highway as a concession with private financing in return for the concessionaire being allowed to charge tolls for the roads use. In this way there remains the opportunity to deliver the scheme and the benefits that go with it but with the capital costs and financial risks passed to the private sector.

R21 – Railway renewal and upgrade Sofia to Gorna to Varna - the line is the second strategic west-east route connecting Sofia with the North and North East of Bulgaria. The route is double track and entirely electrified. The improvement option proposed is track upgrades, re-signalling and renewal of infrastructure systems. This will provide a higher speed route, with better reliability and improved capacity between Sofia and the Black Sea, which would be to the significant benefit for both passengers and freight. The precise specification for the improvements would be the subject of a detailed planning and design study.

9.4.5.4 Gaps

With the completion of the Hemus Highway and the upgrading of the Sofia to Varna railway line there will be no significant gaps in transport infrastructure in the corridor.

9.4.6 Corridor 6 : River Danube

9.4.6.1 Corridor Description

The Danube River rises in Germany and enters the Black Sea having passed through Austria, Slovakia, Hungary, Croatia, Serbia, Romania, Bulgaria, Moldova, and Ukraine. Since the completion of the German Rhine–Main–Danube Canal in 1992, the river has been part of a trans-European waterway from Rotterdam on the North Sea to Sulina on the Black Sea (3,500 km).

The river is a vital freight route for Europe and for Bulgaria. Approximately 15% of Bulgaria's imports by weight arrive via the River. A smaller proportion is exported (5%) and between 1% and 2% of domestic freight is transported on the river.

The importance of the Danube is confirmed by its designation as part of Pan-European Network (TEN-T) Corridor VII, and part of the EU priority axis No. 18.

9.4.6.2 Master Plan Schemes

Two infrastructure schemes and two plans which would identify further infrastructure projects are recommended for inclusion in the Master Plan. The two plans for the review of port master plans and development strategies would also include identifying areas of land and water to be reserved and safeguarded for future port development (W03).

W11 – Navigation improvements – deepening, repair of control structures, strengthening of banks and restoration of channel alignment required to restore the channel to internationally accepted design standards. Primary benefits of the option will be improved safety and increased river carrying capacity.

W13 – Construction of winter shelter for 39 vessels – Phase 3 of construction of a modern river facility to provide secure and sheltered berthing for 39 Bulgarian and international vessels which navigate the Danube River in the winter months. This facility will contribute substantially to the improvement of the safety for vessels within the Bulgarian section of the navigation channel and is of significance for the international trade routes and shipping on the Danube River. The facility will also provide benefits in reduced environmental impact including water quality. Phases 1 and 2 are already complete and have been funded through the EU PHARE programme.

W41 – Port Lom review of master plans and development strategy – audit and review of Master Plans for all ports under the Lom administration, including definition of future port and terminal requirements, land and water area requirements, required timing of developments, and port development strategy. The masterplan review will include consideration of the separation of the port into three parts, these being Lom, Oryahovo and Vidin. This initiative under the National Ports Development Programme is aimed at stimulating competition and opening the ports up to concessions.

This option is considered to be an essential pre-cursor to consideration of a number of port upgrade and development options proposed in recent years in the Lom region. These developments include:

- port expansion;
- a multi-purpose terminal;
- an intermodal terminal;
- port rehabilitation and capacity improvements;
- port equipment improvements; and
- specialisation of terminals including grain, containers, liquids, and heavy cargo.

W47 – Port Ruse review of master plans and development strategy - audit and review of Master Plans for all ports under the Ruse administration, including definition of future port and terminal requirements, land and water area requirements, required timing of developments, and port development strategy. The

masterplan review will include consideration of the separation of the port into six parts, these being Ruse-East, Ruse-West, Svishtov, Somovit, Silistra and Tutrakan. This initiative under the National Ports Development Programme is aimed at stimulating competition and opening the ports up to concessions.

This option is considered to be an essential pre-cursor to consideration of a number of port upgrade and development options proposed in recent years in the Ruse region. These developments include:

- Ruse – grain terminal, intermodal terminal, port storage yard expansion;
- Ruse Centre – passenger terminal;
- Silistra – Ro-Ro terminal; and
- Ruse, Somovit, Tutrakan – equipment improvements.

9.4.6.3 Gaps

Completion of the two defined infrastructure projects and any infrastructure projects identified from the Port Master Plan and Development Strategy reviews should result in there being no significant gaps in transport infrastructure in the corridor.

9.4.7 Corridor 7 : Black Sea

9.4.7.1 Corridor Description

Whilst not a true corridor the Black Sea is considered here as the primary transport route for goods being imported to and exported from Bulgaria and a vital transit trade route for international goods passing through Bulgaria. Whilst volumes of domestic coastal freight traffic are very small, the majority of Bulgaria's imports (67%) and exports (60%) by weight pass through the Black Sea and its Bulgarian ports.

9.4.7.2 Master Plan Schemes

Two plans which would identify further infrastructure projects are recommended for inclusion in the Master Plan. These would also include identifying areas of land and water to be reserved and safeguarded for future port development (W03).

W14 – Port Varna review of master plans and development strategy – audit and review of Master Plans for all ports under the Varna administration, including definition of future port and terminal requirements, land and water area requirements, required timing of developments, and port development strategy. The masterplan review will include consideration of the separation of the port into three parts, these being Balchik, Varna East and Varna West. This initiative under the National Ports Development Programme is aimed at stimulating competition and opening the ports up to concessions.

This option is considered to be an essential pre-cursor to consideration of a number of port upgrade and development options proposed in recent years in the Varna region. These developments include:

- Varna West - channel capacity improvements, hazardous cargoes terminal, container terminal expansion;
- Varna Lake - access channel depth/air draft increase, grain terminal, fuel terminal;
- Varna East – deepwater berth, Ro-Ro, ferry and passenger terminal;
- Lesport – grain terminal; and
- Varna – logistics centre (general, bulk and containers), intermodal terminal.

W26 – Port Burgas review of master plans and development strategy – audit and review of Master Plans for all ports under the Burgas administration, including definition of future port and terminal requirements, land and water area requirements, required timing of developments, and port development strategy. The masterplan review will include consideration of the separation of the port into four parts, these being Burgas East, Burgas West, Rosenets and Nesebar. This initiative under the National Ports Development Programme is aimed at stimulating competition and opening the ports up to concessions.

This option is considered to be an essential pre-cursor to consideration of a number of port upgrade and development options proposed in recent years in the Burgas region. These include:

- Burgas East – relocation of trades from Terminal East and redevelopment as a combined ferry/road/rail passenger interchange, bulk liquids terminal (Terminal 1), general cargo terminal (Terminal 2B);
- Burgas West – Ro-Ro and ferry terminal (Terminal 3), intermodal terminal;
- Burgas General – LNG terminal, crude oil terminal;
- Rosenets – expansion/reconstruction of crude oil port, dredging of approach channel; and
- Nesebar, Sozopol, Pomorie, Tsarevo and Ahtopol – closing of these ports and relocation of trades to alternative terminals.

9.4.7.3 Gaps

Some of the issues related to transport to and from Bulgaria via the Black Sea are related to factors outside the control of the Bulgarian authorities and cannot therefore be considered within the Master Plan. The prime example of this is the limitation placed on the Bulgarian Black Sea ports by the physical draft restrictions of the Bosporus Straits linking the Black Sea with the Eastern Mediterranean.

9.4.8 Sofia

9.4.8.1 The Corridor

Sofia sits at Bulgaria's financial, social and population centre of gravity. It also sits at the junction or crossing point of 4 of the 5 land corridors described above. As a transport hub and interchange point it is therefore of vital importance to the country's prosperity.

Whilst the Master Plan is not concerned with urban and local transport issues, the movement of people and goods over longer distance to, from and around Sofia is of importance.

9.4.8.2 Committed Schemes

Excepting the ongoing work on Sofia Metro the only significant and strategic transport infrastructure project currently in progress is work on the eastern section of the Southern Arc of the Sofia Ring Road.

9.4.8.3 Master Plan Schemes

Three schemes are recommended for inclusion in the Master Plan.

H15 – Sofia Ring Road Northern Arc - upgrade the Northern Arc section of the Sofia Ring Road to a dual carriageway standard with grade separation of the important junctions and closure of the less important ones. This section will provide a high quality route for transit traffic around Sofia and link the motorways and TEN-T Corridors that converge and intersect at the Capital City. This will encourage through traffic to keep out of Sofia City Centre. Planning for improvements to the Northern Arc is complicated by the uncertainty about land-use development proposals to the north of the city.

The issues associated with development of the Capital City and the integration of different modes of transport within the city and at the urban/rural interface, suggest that a more broad ranging review of options within an overall land-use and urban transport Master Plan for the City should be undertaken before a decision on the most appropriate route is taken.

H16 – Sofia Ring Road Southern Arc - upgrade the Southern Arc section of the Sofia Ring Road to a dual carriageway standard with grade separation of the important junctions and closure of the less important ones. Whilst piecemeal improvements have been and continue to be made to the road many sections are still of a low standard and are in a poor physical condition. Intersections with the radial routes in to the City Centre are a particular problem with very severe congestion. In many areas the road also provides direct access to residential and business properties alongside the road.

A09 – Sofia Airport terminal and runway capacity improvements - whilst not an immediate requirement or priority it is likely that with continuing growth in flights and air passengers at Sofia Airport there will be a medium to long term need to increase both runway and terminal capacity. There may also be a requirement to construct a new runway as a result of environmental pressures and the need to reduce noise exposure impacts.

As a starting point for this option an updated Master Plan should be prepared to replace the currently out-dated master plan for the airport and to inform a future development strategy in line with growing demand and environmental and other objectives.

9.5 Network Strategy Options

This section focuses on interventions that are related to the transport networks and the services on them but which do not involve major new physical infrastructure projects.

The options considered in this chapter are set out in **Table 9.3**.

Table 9.3 - Network Strategy Options

Option No	Option Title
H03	Preparation of network maintenance plan and network asset monitoring system.
H05	Development of a road safety information and education campaign.
H06	Introduction of driver information systems.

Option No	Option Title
R03	Network, station and freight facilities rationalisation.
R05	Preparation of plans for asset and information management and network maintenance.
R07	Review of opportunities for speed enhancements across the network.
R08	Preparation of a plan for upgrading passenger facilities at key stations.
R09	Preparation of a plan for upgrading of information for passengers.
R11	Review and plan for upgrades to locomotives and rolling stock.
W00	Port operational assessments and certification.
W05	Identify opportunities for port efficiency improvements
W06	Identify opportunities for improved efficiency in terminal maintenance procedures
W08	Preparation of waste management plans for all ports
W10	Development of Phase 3 of the Vessel Traffic Management Information System (VTMIS)
W12	Development of a real-time river information system
A02	Air Market study for airports in central and northern Bulgaria
A03	Redefine accountabilities and responsibilities for airport security operations
A08	Route development and marketing study for Plovdiv, Burgas and Varna Airports
IM03	Review of requirements for upgrading public transport interchanges in major centres
IM04	Review of requirements to upgrade water/rail freight transfer facilities at major ports
IM05	Review of requirements for new inter-modal rail rolling stock

Whilst there are some common elements to the options and their objectives that cut across transport modes, they are most sensibly considered within the individual transport modes.

9.5.1 *Highways*

The basic structure and coverage of the highway network in Bulgaria is in principle aligned to the needs of travellers and the support of the efficient movement of goods and services. There are also well developed and appropriate standards set down for the design and construction of new highways.

Deficiencies and inefficiencies in the way the network is managed and improvements are planned, funded and delivered have been addressed in the Master Plan recommendations in Section 9.3 and strategic gaps in highway provision have been considered in Section 9.4.

What remains are a group of options that together will allow the network to be properly maintained and which deal with specific and identified problems of road safety and the lack of information available to road users. They can be divided in to three discrete subject areas:

- Maintenance Planning;
- Road Safety; and
- Information Systems.

9.5.1.1 Maintenance Planning

H03 - Preparation of network maintenance plan and network asset monitoring system - currently planning for maintenance lacks a clear prioritisation of routes or repair works needed and there is no asset condition monitoring system. Under these circumstances it is very difficult to coordinate and prioritise maintenance works throughout the whole highway network.

The option proposes a technical study to ascertain the most appropriate long term maintenance plan and asset condition monitoring system. The report would cover:

- What types of information should be included within an asset condition database;
- The level of detail of information within an asset condition database;
- How the data should be held, who should have access to it and how often it should be updated;

- The identification of priority routes;
- A maintenance regime with minimum standards to be applied to roads with different priorities and at different levels within the national network hierarchy;
- Proposals for procurement and funding of network maintenance; and
- Proposals for monitoring against plan and the long term costs and benefits of maintenance.

The introduction of such a plan will contribute to ensuring improved and timely interventions are provided to maintain infrastructure in a condition appropriate for its function.

A review would not involve any capital expenditure and could take place independently of other options. It should have links to the review of roads infrastructure administration and of the network hierarchy under the H01 management option. There may also be some benefits in shared knowledge of best practice by linking the review to the similar review being promoted for rail infrastructure maintenance (R03).

9.5.1.2 Road Safety

H05 – Development of a road safety information and education campaign - it is acknowledged that trends in road traffic accident numbers and casualty severities in Bulgaria are still rising and that in comparison with other EU countries Bulgaria is one of the worst performers.

Work undertaken within the Bulgarian Government has identified principal target areas for action all of which could be tackled, at least in part, by better education and more public information.

An improved road safety record will have a significant and positive economic impact from reduced costs to the emergency services and hospitals, from reduced cost of delays to other road users and from eliminating the lost income from victims and its contribution to the national economy through wealth generation and taxation income.

There have been many similar and successful campaigns across Europe on which a review of options for development and implementation of a national road safety information and education campaign could be based.

9.5.1.3 Information Systems

H06 – Introduction of a Driver Information System - currently, with the exception of some radio broadcasts, there is no information provided to drivers before or during their journey on accidents, congestion or other problems on the highway network. This makes it very difficult for a driver to choose an alternative route or mode of travel or to alter the time of their journey when there are problems on the road ahead.

The option proposes a feasibility study to establish the need for a Driver Information System and the extent of the benefits from its introduction as well as the capital and operating costs for the systems' establishment throughout the whole country.

The benefits of a successful scheme as evidenced by the introduction of similar systems around the world would include passenger and freight travel time savings together with reduced vehicle operating cost savings by significantly reducing idle time in congestion and offering better utilisation of the whole network. Spinoff benefits would also include positive impacts on the quality of air and noise emissions, and reduction of the number of accidents on the national highway network.

9.5.2 *Railways*

The basic structure and coverage of the railway network in Bulgaria is in principle aligned to the needs of travellers and the support of the efficient movement of goods and services. The network also benefits from a high degree of electrification. There are well developed and appropriate standards set down for the design and construction of new railways.

Deficiencies and inefficiencies in the way the network is managed and improvements are planned, funded and delivered have been addressed in the Master Plan recommendations in Section 9.3 and strategic gaps in railway network provision have been considered in Section 9.4.

What remains are a group of options that together will allow the network to be better maintained and which deal with specific and identified operational problems. For the purposes of the Master Plan they can be usefully grouped in to two categories; the physical asset and facilities and information for users.

9.5.2.1 The Physical Asset

There are four railway network strategy options that are recommended for inclusion in the Master Plan related to the state of and utilisation of the railway's physical assets.

R03 – Network, station and freight facilities rationalisation - this requires a review of existing assets and consideration of rationalising stations, freight facilities and track where revenue expectations are below the long run expected costs taking into account wider social and economic factors. These financial savings could then be invested more effectively on other areas of the network. An example of how efficiencies could be made is the evidence that of the 734 stations within the country in 2007, 154 (21%) handled less than 1,000 passengers over the course of the whole year.

R05 – Preparation of plans for asset and information management and network maintenance - the proposal is to prepare a comprehensive management information and asset register for the state rail network, thus enabling maintenance and renewals work to be carried out more efficiently and pro-actively, rather than reactively. Maintenance would be planned to meet route demand with resources prioritised effectively. This initiative would be most effective if it was implemented following the completion of the rationalisation programme option R03.

R07 – Review of opportunities for speed enhancements across the network - this option will involve a review of the network to identify route sections where opportunities exist to raise line speeds and consequently reduce journey times. This will involve the identification of operational planning opportunities, followed by an analysis of the potential to improve rolling stock performance and capability to reduce journey times. Together with infrastructure improvements, this is potentially important to the long term competitiveness of rail and to the delivery of wider economic and environmental benefits. This would be a network wide review that would incorporate work associated with the rail corridor improvement recommendations in Section 9.4. As with R05 the initiative would be most effective if it was implemented following the completion of the rationalisation programme option R03.

R11 – Review and plan for upgrades to locomotives and rolling stock – the option entails a review of the current stock of locomotives, passenger coaches and freight wagons in terms of numbers, functionality and reliability and in the light of operational and commercial needs both now and as forecast in to the future. This would be the basis of developing a plan for scrapping, upgrading of existing stock and procurement of new stock that will meet the requirements of the railways and result in improvements in operational performance and reductions in operating costs. A particular example arises from the mountainous nature of the country and consequent numerous sharp curves, this leads to significant benefits from the introducing of tilting trains.

In combination with the rationalisation of track, stations and freight facilities, the upgrading of locomotives and rolling stock will be vital to a successful future of Bulgarian railways.

9.5.2.2 Facilities and information for users

There are two railway network strategy options that are recommended for inclusion in the Master Plan that are related to improving the experience of the travelling public in planning for their journey and at stations.

R08 – Preparation of a plan for upgrading passenger facilities at key stations - facilities at many stations are not up to standards expected for a modern transportation system. This acts as a deterrent to passengers using the rail network. An upgrade of passenger facilities is therefore required at a number of critical stations to bring them up to standards found in other European countries. A station improvement programme would be most effective if it followed on from the options to carry out the network rationalisation programme (R03) and the asset register (R05). The recommended review would begin with a detailed audit of passenger facilities at each station and a comparison of existing standards with annual passenger flow.

R09 - Preparation of a plan for upgrading of information for passengers - information available to rail passengers throughout the complete journey experience is of a poor standard. The lack of access to timetable, train running and availability information, acts in many cases as a deterrent to using rail transport. The option requires the provision of enhanced customer information systems including better timetable and real time running information. Better information will facilitate easier journey planning and raise confidence in service provision especially where interchange is required. There is an opportunity to maximise the effectiveness of such an initiative by linking it to the proposed driver information system (H06) as the basis of a national travel planning website covering all modes of transport.

9.5.3 Waterborne Transport

Sections 9.3 and 9.4 have identified Master Plan measures to address issues relating to the management and administration of waterborne transport by river and sea together with proposals for infrastructure improvements on the Danube River and for port reviews prior to recommendation of detailed proposals for new port facilities.

What remains are a group of options that together will allow issues related to operations and correct regulation and certification to be addressed. For the purposes of the Master Plan they can be usefully grouped in to two categories; port operations and navigation information systems.

9.5.3.1 Port Operations

Bulgarian ports do not in all cases meet the latest requirements for compliance and certification which must be addressed to ensure adherence to appropriate safety, environmental and security standards. Additionally operational practices do not always match best practice and therefore operational efficiency can be compromised.

W00 – Port operational assessments and certification – there is an identified need to achieve and maintain international and European standards of operation, safety, security and environmental protection for ports and vessels. This recommended option has three principal components:

- Assessment and certification of operational fitness of ports;
- Port safety and security evaluation and upgrading; and
- Operational and environmental regulation compliance audits.

The outcome will be ports and vessels that comply with EU and International Ship and Port Facility Security (ISPS) decrees, certifications and codes supported by appropriate quality assurance procedures which are regularly reviewed through ongoing compliance audits. In this way the ports will remain "user friendly" and maintain their competitive position amongst ports in South-East Europe.

W05 – Identify opportunities for port efficiency improvements - Cargo handling rates are generally slow by modern standards with excessive vessel wait and service times, as a result the ports are potentially less competitive compared to those in neighbouring countries. The option would evaluate all causes of slow vessel turnaround times and identify measures to be implemented to correct the situation.

W06 – Identify opportunities for improved efficiency in terminal maintenance procedures - much of Bulgaria's port infrastructure is old and in poor condition. It is clear that there is a lack of maintenance management procedures and insufficient investment in maintenance and upgrade activities. Improvement in maintenance procedures is considered an essential element in maximising terminal capacity and efficiency. This option will examine the maintenance problems being experienced by the port infrastructure companies and the port operating companies and develop appropriate maintenance and repair management strategies.

W08 – Preparation of waste management plans for all ports - pollution prevention and control facilities, including collection and treatment of waste from ships and from port operations, are inadequate and present unacceptable environmental risks. The option involves the preparation of waste management plans for all ports, development of a database for wastes from ships, construction of receptacles and treatment facilities and introduction of environmental management and control systems.

9.5.3.2 Navigation Information Systems

One of the weaknesses in Bulgaria's waterborne transport has been the unsatisfactory number of modern logistic, navigation and information systems, including real-time navigation information systems. This applies to both the Black Sea and the River Danube. Building on work already underway with the Vessel Traffic Management Information System the options below seek to bring Bulgaria's systems up to modern European standards.

W10 – Development of Phase 3 of the Vessel Traffic Management Information System (VTMIS) – this would be the vital third and final stage of the VTMIS extending the coverage of the system to include the Bulgarian Black Sea region allowing comprehensive information exchange between ships and shore-based management operations and control. Completion of development of the system is considered to be essential to achieving overall navigation management procedures meeting European operational standards, with a system able to integrate with those of neighbouring countries.

W12 - Development of a real-time river information system - navigation hazards on the River Danube include swift changes in water depths, channel obstructions, stranded vessels, ice drift, storms and fog and currently there is no system for timely warnings to vessels about such hazards to navigation. The system will be designed to continuously collect and process all physical data relevant to navigation of the river, including channel geodetic, hydrographic, morphological, hydrological, meteorological and statistical data. This data will be made available in real time, enabling continuous monitoring by navigators.

The option would work in parallel with VTMIS (W10) and benefit from the navigational improvements recommended in W11.

9.5.4 *Aviation*

Despite falls in passenger numbers in the 12 months to September 2009 at Bulgaria's main airports, reversion to long terms trends is likely to put increasing pressure on existing facilities and indicate the requirements for new developments. Apart from addressing landing charges and the need for capacity improvements at Sofia Airport there is a clear need to undertake a full appraisal of likely future market trends and market demands to allow the long term planning for the aviation sector. This is reflected in two of the three strategy recommendations. The third is related to a specific requirement to review airport security operations.

9.5.4.1 Air Market Studies

It is recommended that the Master Plan includes for two Air Market studies covering all significant airports apart from Sofia. A recommendation for updating the airport master plan including an air market study is made as part of the proposals to review capacity requirements at Sofia Airport (A09).

A02 – Air Market study for airports in central and northern Bulgaria - currently there are two non-operational airports in northern and central Bulgaria (Ruse and Turgovishte) as well as the operational airport at Gorna Oryahovitsa although Gorna has no scheduled passenger services. Attempts at securing concessions for Gorna Oryahovitsa and Ruse Airports have not been unsuccessful. This would suggest that given current population levels in this part of Bulgaria, reasonably low tourism activity and the current economic climate, demand for business and leisure air travel in northern and central Bulgaria appears to be relatively low. However, this is an unknown quantity, as is the future demand for business and leisure air travel in northern and central Bulgaria.

The recommendation is for a study to assess demands in terms of airport strategy for the area to inform future airport development/concession strategies for the airports and indicate whether there is potential for any airports to operate in this part of Bulgaria.

A08 – Route development and marketing study for Plovdiv, Burgas and Varna Airports - a common characteristic at all of these airports is the highly seasonal nature of traffic with high summer peaks at Varna and Burgas Airports and a high winter peak at Plovdiv Airport. Overcrowding and poor passenger service levels as well as aircraft apron congestion during the busy summer peak at Burgas and Varna airports are related to seasonal traffic. The option proposes that a study is undertaken which would investigate air market demand for the three airports and result in a strategy for year-round sustained provision of services. Any work related to Burgas and Varna would need to be undertaken in co-operation with the airport operator FRAPORT Twin Star Airport Management.

9.5.4.2 Security Operations

A03 – Redefine accountabilities and responsibilities for airport security operations - currently there are a number of parties providing security services at Bulgarian airports and as such accountabilities and responsibilities are not always clear. Therefore there is potential for either overlap or gaps in accountabilities/responsibilities as well as for disagreements over resources and funding. This recommended option would seek to redefine and clarify accountabilities and responsibilities for the various parties providing security services at Bulgarian airports with the objective of delivering a rationalised system.

9.5.5 *Inter-Modal Transport*

Promotion of inter-modal transport for both passengers and freight is one of the five priority axes in the OPT (2007-2013) with the objective of facilitating and improving the conditions for transporting people and freight from one type of transport to other and so encourage the maximum use of environmentally sustainable forms of transport. Section 9.4 made recommendations regarding two important new inter-modal terminals. In the options below options are put forward for the upgrading of network facilities and inter-modal vehicles for passenger interchange and freight transfer.

9.5.5.1 Passenger Interchange

With very few exceptions facilities for travellers to change transport mode at major transport hubs are limited and in most case there is little or no integration between timetables for different types of public transport. As a result people may be discouraged from making journeys by public transport if they have to change modes in the course of their journey.

IM03 – Review of requirements for upgrading public transport interchanges in major centres – the recommended option is for a technical study to identify the need for, scope of and location of improved interchanges between public transport modes at major transport hubs in Bulgaria and the positive and beneficial effect it would have for the service offered to travellers. Any work associated with the

improvement of rail public transport interchange will need to be linked to the recommended review of rail stations and rail station facilities (R03 and R08).

9.5.5.2 Freight Transfer

There is an acknowledged lack of a national network of modern intermodal terminals, serving the needs of rail and water freight. Evidence from discussions with port and rail operators indicates that one of the constraints for the expansion of intermodal trade through the major ports on the Black Sea and River Danube is the absence of high quality interchange facilities and the small fleet of available intermodal rail rolling stock.

IM04 – Review of requirements to upgrade water/rail freight transfer facilities at major ports – the option involves a review of requirements to upgrade water/rail transfer facilities at major ports. The review should be carried out in two stages. Firstly the justification for improvements at a strategic level identifying the need for and most appropriate locations to support broader transport and economic objectives at a national level. This second stage review would allow more detailed feasibility studies within individual ports to be identified and prioritised. Any work in this regard should be linked to the proposals for the port master plan reviews recommended in W14, W26, W41 and W47.

IM05 – Review of requirements for new inter-modal rail rolling stock - the option involves a review of requirements for new inter-modal rolling stock which is appropriate for carriage of containers and lorry trailers both nationally and internationally. Under normal circumstances it could be anticipated that any shortfall in provision would be addressed through a response from the market, with freight operators investing in the rolling stock to take advantage of any latent demand. However the absence of any developed intermodal system or infrastructure in Bulgaria indicates a need for a more strategic review. Any work associated with reviewing the requirement for additional specialist inter-modal rolling stock will need to be linked to the recommended review of rail locomotives and rolling stock (R11).

9.5.5.3 Links with Rail and Water Initiatives

By their nature, inter-modal options cannot be viewed in isolation from the other transport modes. In particular there are clear links with both rail and water initiatives, the modes that are likely to most influence and benefit from investment in intermodal transport. The clearest links are with those options that have the potential to support the introduction or improve the efficiency of intermodal operations, notably R03, R05, R07, R08, R11, W03, W05, W14, W26, W41 and W47.

9.6 The Plan in Summary

Tables 9.4 to 9.6 below summarise the elements of the Master Plan under the different types of intervention and as detailed in Sections 9.3, 9.4 and 9.5.

Table 9.4 - Summary of Management Options

Administration	Funding & Charging	Training & Education
Highways		
H01 – Review of roads infrastructure administration and of network hierarchy	H02 – Review of highway funding and charging	H03 – Review of academic, professional and vocational education and training and role of research institutions
Railways		
R01 – Review of railway administration (RAEA, NRIC and BDZ	R02 - Review of railway funding and charging	R10 – Review of academic, professional and vocational education and training and role of research institutions
Water Transport		
W04 – Review of management of port concession procedures		
W07 – Review of terminal equipment procurement procedures		
Air Transport		
	A01 – Review of airport landing charges	

Table 9.5 - Summary of Corridor Strategies

Highways	Railways	Water Transport	Air Transport	Inter-Modal
Corridor 1 – Serbia (Kalotina) – Sofia – Plovdiv – Turkey (Svilengrad) (TEN-T IV, VIII, IX & X)				
H12 – A3 Maritsa Highway (Chirpan to Harmanli)	R13 – Renewal and upgrade Sofia to Plovdiv to Burgas			IM01 – Plovdiv inter-modal terminal
Corridor 2 – Macedonia (Gyueshevo) – Sofia – Plovdiv – Burgas – Varna (TEN-T IV & VIII)				
H08 – A1 Trakia Highway (Stara Zagora to Karnobat)	R13 - Renewal and upgrade Karnobat to Varna			
H13 – A4 Black Sea Highway (Burgas to Varna)				
H17 – Rila Highway (Dupnitsa to Trakia/Hemus)				
Corridor 3 – Romania (Vidin) – Sofia – Greece (Kulata) (TEN-T IV)				
H19 – Botevgrad to Mezdra, Vratsa Bypass, Montana Bypass, Ruzhintsi to Dimovo	R12 – Renewal and upgrade Vidin to Mezdra to Sofia			
H14 – A6 Struma Highway (Dupnitsa to Kulata)	R14 – Renewal and upgrade Sofia to Kulata			
Corridor 4 – Romania (Ruse) – Veliko Tarnovo – Haskovo – Greece (Makaza) (TEN-T IX)				
H23b – Ruse to Makaza via Veliko Tarnovo, Pass of the Republic and Dimitrovgrad	R23 – Renewal and upgrade Ruse/Gorna Oryahovitsa/S Zagora			IM02 – Ruse inter-modal terminal
Corridor 5 – Sofia – Veliko Tarnovo – Shumen – Varna (TEN-T IV)				
H10 – A2 Hemus Highway Sofia Ring Road to Yana	R21 – Renewal and upgrade Sofia/Gorna/ Varna			
H11 – A2 Hemus Highway Yablanitsa to Shumen				
Corridor 6 – River Danube (Confluence of Timok River to Silistra) (TEN-T VII)				
		W11 – Navigation improvements		
		W13 – Construction of winter shelter for 39 vessels		
		W41 – Port Lom review of master plans		
		W47 – Port Ruse review of master plans		
Corridor 7 – Black Sea				
		W14 - Port Varna review of master plans		
		W26 - Port Burgas review of master plans		
Sofia				
H15 – Sofia Ring Road Northern Arc			A09 – Sofia terminal & runway capacity	
H16 - Sofia Ring Road Southern Arc				

Table 9.6 - Summary of Network Strategies

Highways	Railways	Water Transport	Air Transport	Inter-Modal
H03 – Preparation of network maintenance plan and network asset monitoring system	R03 – Network, station and freight facilities rationalisation	W00 – Port operational assessments and certification	A02 – Air Market study for airports in central and northern Bulgaria	IM03 – Review of requirements for upgrading public transport interchanges in major centres
H05 – Development of a road safety information and education campaign	R05 – Preparation of plans for asset and information management and network maintenance	W03 – Identify areas of land and water to be reserved for port use	A03 – Redefine accountabilities and responsibilities for airport security operations	IM04 – Review of requirements to upgrade water/rail freight transfer facilities at major ports
H06 – Introduction of driver information systems	R07 – Review of opportunities for speed enhancements across the network	W05 – Identify opportunities for port efficiency improvements	A08 – Route development and marketing study for Plovdiv, Burgas and Varna Airports	IM05 – Review of requirements for new inter-modal rail rolling stock
	R08 – Preparation of a plan for upgrading passenger facilities at key stations	W06 – Identify opportunities for improved efficiency in terminal maintenance procedures		
	R09 - Preparation of a plan for upgrading of information for passengers	W08 – Preparation of waste management plans for all ports		
	R11 – Review and plan for upgrades to locomotives and rolling stock	W10 – Development of Phase 3 of the Vessel Traffic Management Information System (VTMIS)		
		W12 – Development of a real-time river information system		

The Master Plan Highway and Railway infrastructure projects are shown on a geographic base in **Figures 9.2** and **9.3.**

Figure 9.2 – Master Plan Highway Options

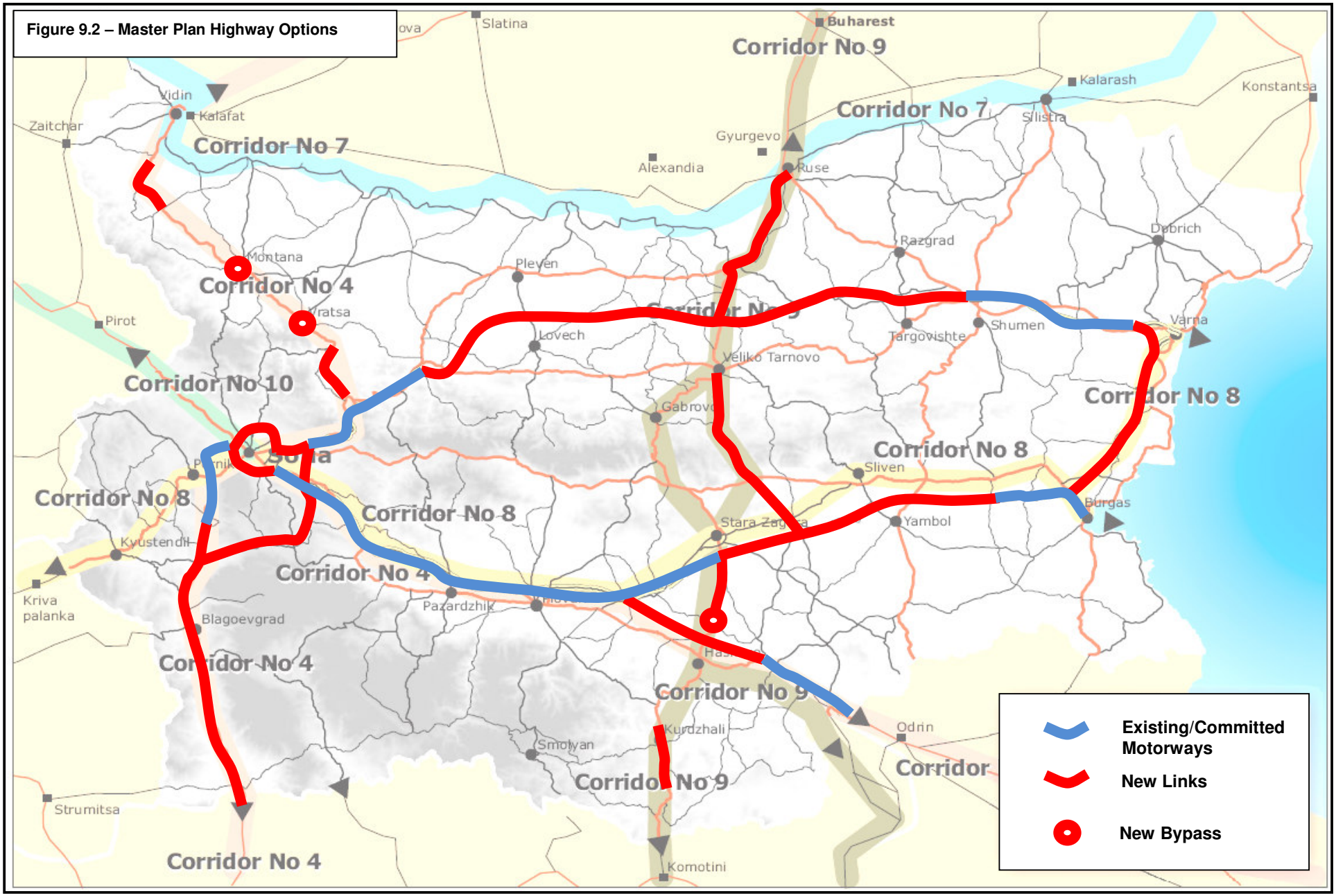
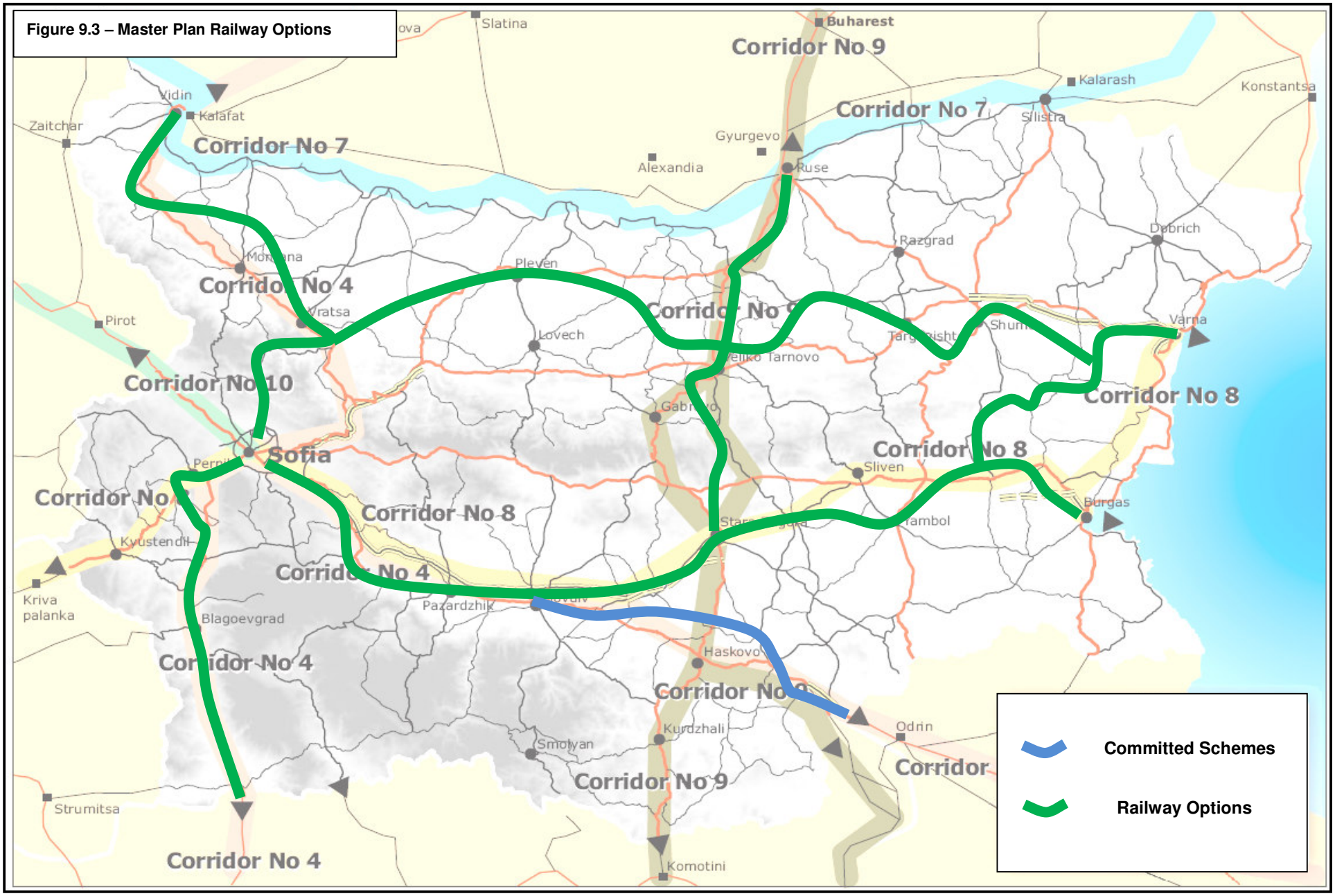


Figure 9.3 – Master Plan Railway Options



9.7 Evaluation of the Master Plan

9.7.1 *Introduction*

The approach to the evaluation of the overall Master Plan followed the same methodology as that used for the individual options. That was using an Assessment Summary Table which measured in quantitative and qualitative terms the performance of the Master Plan against agreed objectives. The objectives fall under eight principal headings:

- Strategic, policy and legal;
- Economic and financial;
- Social;
- Environmental;
- Safety and security;
- Fundability;
- Deliverability; and
- Risk.

Under each of these principal headings are a number of sub-objective headings.

Additionally, and in the case of those major infrastructure proposals where they have been sufficiently developed and where it is appropriate in relation to the type of project, a standardised cost-benefit analysis was also undertaken.

9.7.2 *Assessment Summary*

The assessment summary for the Master Plan covering all options in Tables 9.4, 9.5 and 9.6 above is presented in **Table 9.11**.

This clearly demonstrates that the overall strategy produces very positive results against the majority of the assessment objectives. The only areas where there are potentially negative impacts are in relation to environmental considerations. This is as would be expected in a strategy that comprises of very significant new infrastructure projects, particularly in relation to new highway construction. This serves to emphasise the importance of very careful design to minimise any negative environmental impacts and also to demonstrate the need for appropriate mitigation.

9.7.3 *Cost Benefit Analysis*

As part of the process of bringing the Master Plan together additional work was undertaken to refine the cost benefit analyses (CBA) undertaken for the individual major infrastructure proposals. This was to ensure that in the context of a strategic appraisal they were presented at an appropriate level of detail and were consistent with each other.

The CBA results for the individual schemes based on the adopted central values for economic growth and population change are shown in **Table 9.12**.

In the case of all individual highway schemes recommended for inclusion in the master Plan the ratio of monetised benefits to costs is in excess of 1.0. This is an indication that the benefits that will accrue over the project evaluation period will be higher than the costs for construction and operation. As such this demonstrates that leaving aside the non quantifiable benefits the projects will generate there is a sound economic case to proceed with the projects.

The two schemes with the highest ratio of benefits to costs are the Northern and Southern Arcs of Sofia Ring Road. This is because of the very high travel time savings that can accrue by relieving traffic congestion on busy urban roads. This is particularly pronounced in the case of the Southern Arc where congestion and delay on the existing ring road is acute.

The two schemes with the next highest benefit to cost ratios are the completion of the Trakia Highway between Stara Zagora and Karnobat and the Hemus Highway between the Sofia Ring Road and Yana. These results serve to confirm the view that completion of these two sections of highway are of vital importance to Bulgaria.

The CBA's for the individual rail schemes produce high levels of user benefits, over €800,000,000 in the case of the project to upgrade the line from Sofia to Burgas and Varna via Plovdiv and introduce high speed tilting trains. However in each case the very high costs for construction as currently estimated outweigh the benefits. Therefore on the basis of a purely economic appraisal the railway schemes are less easy to justify than the highway schemes. It is the case, however, that the railway schemes score

very highly when examining those benefits where it is more difficult to derive monetary values. In particular these include:

- Development of sustainable transport;
- Encouraging inter-modality and transport integration;
- Accessibility to transport services for the socially disadvantaged; and
- Security of transport provision in relation to increasing cost and diminishing supply of fossil fuels on which road transport is more highly dependent.

For this reason railway investment projects are a central part of the overall Master Plan

The CBA results for all the highway and rail infrastructure schemes combined are also shown in **Table 9.12**. In composite terms this shows benefits of € 8.7 billion and costs of € 5.9 billion, giving a surplus or net present value of €2.8 bn and a benefit to cost ratio of 1.47. This clearly demonstrates the cumulative value of the projects in combination which is maintained despite there being some competition for benefits between individual schemes.

9.7.4 *Commentary*

In addition to the evidence of the assessment summary table and the cost benefit analysis it is also important to review the performance of the overall plan and strategy against the principal objectives set out at the outset of the study against which the success of a Master Plan would be judged.

Firstly there is the key theme set in the EU White Paper "European Transport Policy for 2010: Time to Decide" to achieve "Mobility for all citizens that is sustainable in economic, social and environmental terms". This theme is central to the assessment of any transport scheme or Master Plan throughout the EU – the proposed Master Plan provides a significant improvement in mobility which is balanced and favours no one group in society above other groups.

Secondly there are the goals as set out in the Technical Specification for the Master Plan Project:

- Ensure the mobility of persons and goods under the best possible social and safety conditions, while supporting the achievement of the Community's objectives, particularly in regard to competition and environment, and contributing to the strengthening of economic and social cohesion – *these objectives underpin the development of the Master Plan and are reflected in the objectives presented in the Assessment Summary Table*;
- Ensure the planning of a high-quality infrastructure on acceptable economic terms – *the emphasis in the Plan is on high standard projects which meet the anticipated future transport demands and therefore provide value for the investment made;*
- Include all modes of transport, taking into account their relative advantages – *the plan is balanced and integrated including projects across all modes of transport and that provide for linkages between the modes;*
- Allow the optimal usage of existing infrastructure capacity – *a major part of the plan is maintaining the existing infrastructure that is in place and improving its management so as to maximise its potential*;
- Encourage the operational harmonization and intermodality between the different modes of transport – *this is reflected in the strong emphasis on improvements to rail and water infrastructure and inter-modal facilities;*
- Be feasible on a macro-economic level – *the scale of investment proposed (€6+ bn) is very high but not out of scale with the potential funding available over the medium term*; and
- Contribute to the implementation of transport activities conformable to the environmental requirements – *projects have been developed with the aim of minimising or mitigating environmental impacts set in the context of ensuring an efficient and effective transport system.*

Thirdly there are the transport investment policies and priorities set out in the "National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria and Action Plan for the Period 2006-2015":

- Build and develop the key transport infrastructure connections of national, cross-border and European importance and to improve the interoperability of the main railway lines – *the principal infrastructure projects contained within the plan support strategic national and international connections with a significant theme of rail investment in schemes which support European connectivity;*
- Develop the national road infrastructure and to integrate it into that of the EU Member States – *investment in national road infrastructure is central to the plan along with integration of the network into those of neighbouring EU member states (Greece and Romania);*

- Develop and improve the road network and to adjust it to European norms and standards – *schemes for the road network are proposed at standards appropriate for the forecast traffic demands and which conform to European norms;*
- Optimise the capacity and efficiency of the existing and new infrastructure - *a major part of the plan is maintaining the existing infrastructure that is in place together with new infrastructure and improving their management and operation so as to maximise their potential*;
- Modernise the infrastructure of the River Danube and sea waterways – *there are a number of different schemes specifically aimed at improving waterway and port infrastructure;*
- Improve the conditions for navigation and promotion of intermodal transport - *there are a number of different schemes specifically aimed improving navigation channels and information systems available for vessels on the Danube and Black Sea;*
- Develop and modernise airports and adjust them to the requirements of the European Union in the field of the protection of the environment – *proposals are clearly focussed on developing and modernising those airports that can best serve the needs of Bulgaria and its connectivity with other EU countries acknowledging the need to protect environmental interests;* and
- Promote public-private partnerships – *schemes within the plan have been identified for highways, water transport and air transport which will help promote the involvement of the private sector in financing and operations.*

Finally the plan needs to contribute to the broader Bulgarian objectives set out in overarching policy documents which seek to ensure the maximum economic, social and environmental benefits for the whole country, rather than simply transport users, are achieved. These are set out as the Bulgarian Government vision for the country as an EU member state in the "National Strategic Reference Framework for the 2007-2013 Programming Period" that "By 2015 Bulgaria should become a competitive EU country with high quality of life, incomes and social awareness" realised through two medium term goals:

- Strengthen the competitiveness of the economy to achieve high and sustainable growth; and
- Develop human capital to ensure higher employment, income and social integration.

Delivery of the Master Plan and its complementary and integrated projects will ensure that transport contributes the maximum advantage to the country's sustainable economic growth and delivers increasing prosperity for its people.

9.8 Environmental Assessment

9.8.1 Introduction

This section provides a summary of an Environmental Assessment which was carried out to inform the development of the GTMP. It explains the legislative basis for carrying out the Environmental Assessment (hereafter referred to as 'EA'), describes keys aspects of the EA process and sets out some of the key findings.

More detailed information regarding the EA and its findings is available in the Environmental Report.

The purpose of EA is to integrate environmental factors into the preparation of the plan. In addition to integrating environmental considerations within the plan, EA also increases public/stakeholder involvement in plan-making and facilitates transparency. This is achieved through statutory public consultation during the process of preparation of the draft plan and the EA report which are prepared in accordance with the legal requirements.

There are a number of essential elements to any EA:

- The EA must be integrated at the earliest possible stage within the process of developing the plan. It is an iterative process which should provide the necessary information for decision-making during plan development;
- consultations with relevant environmental authorities are required during the preparation of the preliminary scope of the EA;
- The Environmental Report must be produced so that it sets out clearly the findings of the EA;
- The Environmental Report must be published with a draft version of the plan for a period of public consultation; and
- A summary must be prepared and published in the draft plan after consultation with the competent environmental authorities which presents the way in which the EA results are taken into account, the opinions received from the consultations and the opinion of the competent environmental authority on the final draft of the plan.

9.8.2 *The Requirement for Environmental Assessment*

EA of plans and programmes, sometimes referred to as *Strategic Environmental Assessment (SEA)*, is a systematic approach for considering the environmental effects of certain strategic plans and programmes.

9.8.2.1 European Legislation

Environmental assessment as a procedure was introduced by Directive 2001/42/EA of the European Parliament and the Council on 27th June 2001 to assess the effects of certain plans and programs on the environment. The Directive describes the EA procedure as a high level of environmental protection and to contribute to the integration of environmental considerations in the preparation and adoption of plans and programs to support sustainable development. All Member States were required to transpose the Directive into their respective national legal frameworks by July 2004.

The Directive requires all Member States to carry out formal environmental assessment of public sector plans and programmes which are likely to have significant negative effects on the environment. It applies to the following sectors:

- Agriculture;
- Forestry;
- Fisheries;
- Energy;
- Industry;
- Transport;
- Waste management;
- Water management;
- Telecommunications;
- Tourism; and
- Spatial planning and land use.

9.8.2.2 Bulgarian Legislation

The Directive was transposed into Bulgaria through two pieces of legislation:

- Regulation on the procedures for conducting environmental assessment of plans and programs; and
- Environmental Protection Act.

The Regulation on the Conditions, Procedure and Methods for Environmental Assessment of Plans and Programs[1] *(*Annex 1 to Article 2, paragraph 1) states that EA is mandatory for plans and programmes including the following:

- 4.1 Roadways Act - Medium-term and Long-term Programs for Development of the Roadways Network
- *4.2* Railway *Transport Act - Program for the Development of the Railway Transport and the Railway Infrastructure;* Long-term Program for Development of the Railway Infrastructure and its Safe and Reliable Exploitation, Including Crisis Situations (Acts of God, Acts of Terrorism and Warfare)"

Further to this, the Regulation (Annex 1 to Article 2, paragraph 1) states that EA is mandatory for plans and programmes which set out a framework for the following types of future transport development:

- 3.1 Roadways Act - Programs for Development and Improvement of the Republican Roads
- 3.2 Civil Air Flights Act - General Plan for Development of the Airports
- 3.3 Sea Areas, Inland Waterways and Ports in the Republic of Bulgaria Act - General Plans for Building, Reconstruction or Enlargement of the Ports and the Navigation Equipment"

9.8.2.3 Determining the Need for the EA of the GTMP

It was considered necessary to carry out an EA of the GTMP for the following reasons:

- The GTMP is a public sector transport masterplan;
- The GTMP covers rail, road, aviation and port development. It sets a framework for the development of several large scale projects, including new and upgraded roads, airport and ports; and
- The GTMP covers the entire country of Bulgaria, which includes numerous sensitive environmental sites.

[1] Adopted with Letter of the Council of Ministers No 139 of 24.06.2004, promulgated in State Gazette, number 57/ 2.07.2004, enforced as of 1.07.2004.

Given the geographic context of the plan, the scale of the projects which it promotes and the sensitivity of some of the environments potentially affected, it was considered likely that significant effects could occur through the implementation of the GTMP. As a result it was considered necessary to undertake a full EA.

The Minister of Transport submitted a request to assess the need for carrying out the EA to the Ministry of Environment and Water. The Ministry of Environment and Water responded with a Decision № EO-6/14.10.2008, which confirmed the need for an assessment and explained the coverage requirements

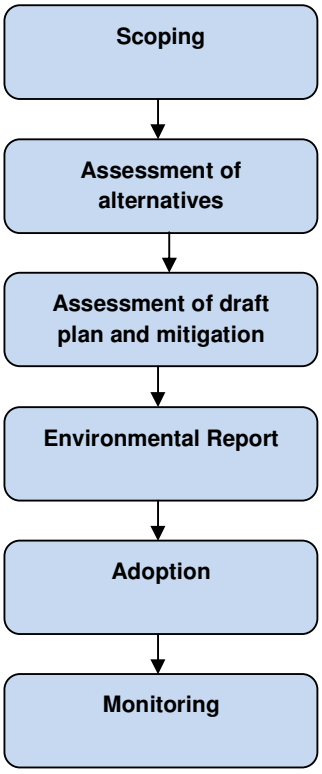
9.8.3 The Environmental Assessment Process

9.8.3.1 Key Stages in the Environmental Process

There are a number of generic requirements for any EA which are underpinned by national and EU legislation, as well as good practice guidance. All EA's should be integrated within the development of the plan and should follow a similar process. This section describes each key stage in the EA process.

These key stages are fundamental to ensuring the process is both open and iterative. They stages are set out in order in **Figure 9.4** below, with summary text following:

Figure 9.4 - Key Stages in the EA Process



9.8.3.2 EA Tasks

Certain tasks are carried out within each of the above stages. **Table 9.7** below provides more details regarding what is required of each stage:

Table 9.7 - EA Stages and Tasks

Stage	Task
Scoping	Setting the content
	Identifying environmental topics
	Identifying existing environmental problems
	Identifying other relevant plans, programmes and environmental protection objectives
	Collating baseline information

Stage	Task
	Identifying potential environmental effects
	Developing assessment methodology
	Identifying appropriate level of detail for the assessment
	Preparing Scoping Report
	Formal consultations with the competent authorities on the Scoping Report
Assessment of alternatives	Developing and refining options (alternatives)
	Assessing the environmental effects of options
	Assessing the social and economic effects of options
	Selecting preferred options
Assessment of draft plan and mitigation	Developing draft plan based on preferred options
	Assessing environmental effects of the individual elements within the plan e.g. schemes or policies
	Assessing cumulative and synergistic effects of the plan
	Developing measures to mitigate (prevent, reduce or offset) environmental effects
	Developing proposed measures to monitor and control environmental effects
	Preparing EA Report, containing the results of the assessment, mitigation and monitoring proposals
	Formally consulting the public and the statutory consultee on the draft plan and EA Report
Adoption	Considering comments and standpoints from the consultation phase
	Preparing final EA report taking these standpoints into account
	Formally adopting the finalised EA report to include the standpoint for harmonising the plan from the competent environmental authorities
Post-adoption and monitoring	Producing a summary verification statement containing details of how the EA and relevant comments from consultation have been addressed by the final version of the plan
	Monitoring the environmental effects of the plan

9.8.3.3 Scoping

The purpose of scoping is to set the context for the environmental assessment. The responsible authority (Ministry of Transport) is required to consult the statutory authority for EA (Ministry of Environment and Water) on the proposed scope and level of detail proposed for the assessment. It is standard practice for this to be done with a Scoping Report which is submitted for formal consultation. Information typically provided in the Scoping Report includes:

- Background information regarding the plan, for example the purpose, objectives and likely content of the plan;
- The relationship of the plan with other plans and programmes;
- Existing relevant environmental problems;
- Environmental baseline information; and
- Assessment methodology, including information regarding the proposed level of detail.

9.8.3.4 Environmental Assessment of Alternatives and Draft Plan

In addition to assessing the plan itself, the Directive requires the EA to assess 'reasonable alternatives' (often referred to as 'options'). This should be undertaken as the plan develops, to ensure that environmental concerns are taken into account when preferred options are taken forward for inclusion in the draft plan.

Following the selection of preferred alternatives, the draft plan is subject to environmental assessment. As required by the Directive, the plan is assessed on its potential effects on the following environmental topics: *biodiversity, population, human health, fauna, flora, soils, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above components and factors*.

The assessment should take into account the potential for cumulative effects; for example where the plan interacts with other plans or proposals to result in more significant effects.

9.8.3.5 Mitigation

The Directive requires the EA Report to set out measures to prevent, reduce or offset adverse environmental effects. These 'mitigation' measures can be implemented at different levels. For example effects can be mitigated through the choice of alternatives taken forward; more environmentally damaging alternatives can be dropped during plan-development. Alternatively policies can be included within the plan, which commit the responsible authority to implementing measures during construction. Details of how effects have been mitigated are detailed in the EA Report.

9.8.3.6 EA Report

The purpose of the EA Report is to provide information to the public and other stakeholders regarding the likely environmental effects of the proposed plan. It is published with the draft plan for a period of public consultation. Comments made during the consultation phase must then be considered in the development of the final EA report and plan.

The EA Report primarily sets out the findings of the environmental assessment and identifies measures for mitigating effects. It also sets the context for the environmental assessment by identifying other relevant plans and programmes, existing environmental problems and the baseline situation.

Annex 1 of the Directive requires the following information to be included in the Environmental Report:

a) *an outline of the contents, main objectives of the plan or programme and relationship with other relevant plans and programmes;*

b) *the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme;*

c) *the environmental characteristics of areas likely to be significantly affected;*

d) *any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any subjects of a particular environmental importance, such as areas designated pursuant to Directives 79/409/EEC*[2] *and 92/43/EEC*[3]*;*

e) *the environmental protection objectives, established at international, Community or Member State level, which are relevant to the plan or programme and the way those objectives and any environmental considerations have been taken into account during its preparation;*

f) *the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors;*

g) *the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme;*

h) *an outline of the motives for selecting the alternatives dealt with, and a description of how the assessment was undertaken including any difficulties (such as technical deficiencies or lack of know-how) encountered in compiling the required information;*

i) *a description of the measures envisaged concerning monitoring and control in accordance with Article 10; and*

j) *a non-technical summary.*

[2] Birds Directive

[3] Habitats Directive

9.8.3.7 Adoption

Following the period of consultation on the draft plan and the EA Report, any comments made are considered as the final plan is prepared and after this the final plan must be agreed with the Client.

The Directive requires the responsible authority to produce a statement outlining how the EA and relevant consultation responses pertaining to the EA or environmental concerns have been taken into account in the final plan.

The statement is submitted to the statutory competent authority (MoE&W) after it has been approved and the verification is published by the Client to guarantee its public access.

9.8.3.8 Monitoring

There is a requirement under the Directive for the environmental effects of the plan to be monitored throughout its implementation. Through doing this, it is possible to determine if the plan performs as predicted in terms of its environmental effects. It also enables the identification of unforeseen adverse effects, allowing remedial action to be taken if necessary.

Monitoring proposals are set out in the Environmental Report which is subject to consultation. Finalised monitoring commitments are set out in the statement of the competent authority (MoE&W).

9.8.4 The EA of the Bulgaria GTMP

9.8.4.1 Summary

The previous section described the generic stages required for any EA. This section provides more specific information regarding the tasks and outputs for the EA of the Bulgaria GTMP. **Table 9.8** below summarises key information and dates relevant to this EA.

Table 9.8 - Environmental Assessment – Key Information

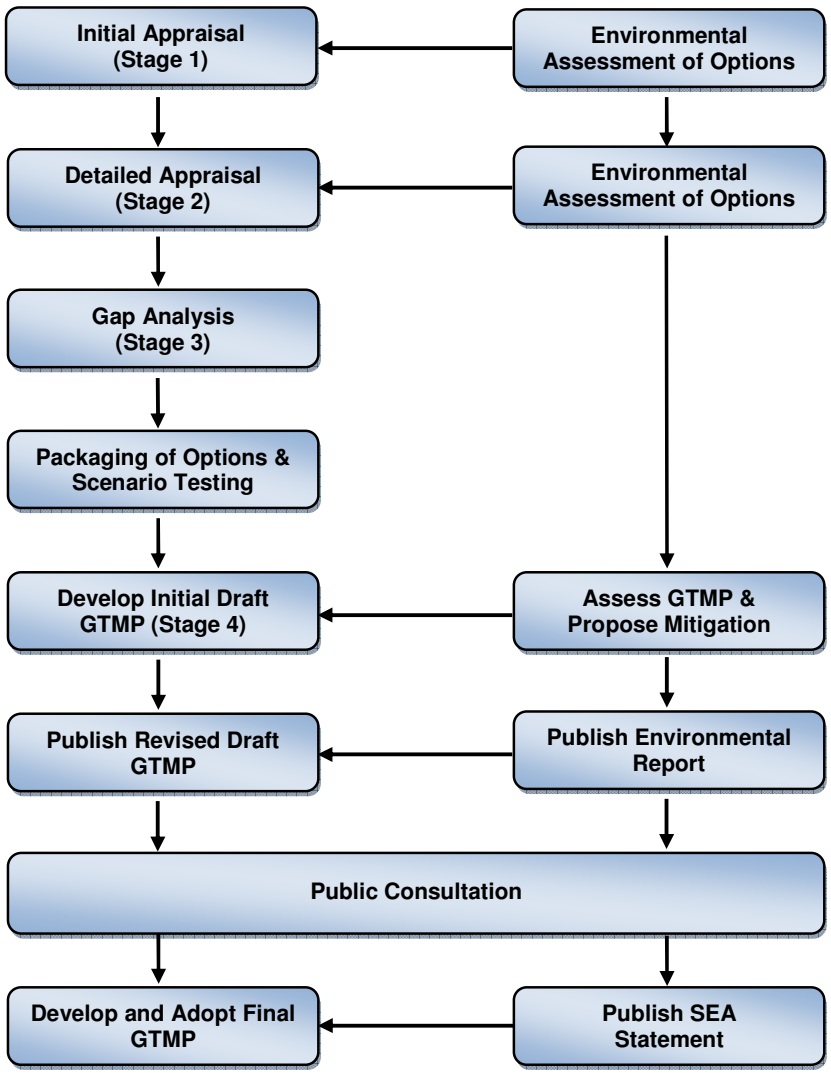
Scoping	The Scoping Report set out the proposed scope of the EA and the structure of the EA Report. It was submitted to the Ministry of Environment and Water on 1 September 2009. A response was received which was generally supportive of the proposed approach. Comments were taken into account during the assessment and compilation of the Environmental Report.
Assessment of alternatives	Various options (also referred to as 'alternatives') were considered for inclusion in the GTMP. These options included major schemes and management approaches. As the options were developed and refined they were assessed on their impact or performance in a number of areas. These option appraisals considered: ■ Strategic, policy and legal issues; ■ Economic and financial impacts; ■ Social impacts; ■ Environmental impacts; ■ Safety and security; ■ Fundability; ■ Deliverability; and ■ Risk. The environmental assessment of options was undertaken by the EA team. The results of this exercise were presented in *Key Report 7: Detailed Appraisal of Options*, which was completed in September 2009. Through this assessment process a number of options were dropped, for a variety of reasons, including technical feasibility, economic constraints or environmental effects. Preferred options were taken forward and developed further for inclusion in draft GTMP.
Assessment of the GTMP	Following selection of the preferred options, a draft GTMP was developed and subject to a full environmental assessment. The assessment considered the potential effects of the GTMP on the following environmental topics: biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets and cultural heritage including architectural and archaeological heritage. This included an assessment of cumulative and synergistic effects. The assessment methods are set out in the Methodology section of the EA Report.

Mitigation	Following the environmental assessment of the GTMP a series of measures were developed with the purpose of mitigating the predicted environmental effects. The measures are noted in the Environmental Report and have also been adopted by the GTMP. They are included in Section 9.8.7
Environmental Report and public consultation	The Environmental Report containing a summary of the assessment findings was published with the draft GTMP for a period of public consultation. The Environmental Report also contains details of mitigation and monitoring proposals. The Environmental Report and draft GTMP were published on the Ministry of Transport's website in December 2009. Consultation responses were received and have been taken into account in the development of the final GTMP.
Post-adoption and monitoring	Following the adoption of the GTMP, a summary verification will be submitted by the responsible authority to the Ministry of Environment and Water, describing how the EA and consultations have been taken into account. This will be done before the final approval and the acceptance of the GTMP.

9.8.4.2 Links between the EA and the GTMP

It is important to note that the EA cannot exist in isolation but instead has informed the GTMP as it has developed. **Figure 9.5** below shows where the EA process has interacted with the process for developing the GTMP.

Figure 9.5 - The EA and GTMP Development



9.8.5 Findings of the Environmental Assessment

This section summarises the results of the environmental assessment. Based on the assessment results, mitigation measures were devised to prevent, reduce and offset effects. These are also summarised below. Finally the measures proposed to monitor environmental effects throughout the lifetime of the plan are summarised.

9.8.5.1 Assessment Results

Based on the analysis, projections and estimates of the likely impact on the components and environmental factors resulting from the realisation of the GTMP the following effects can be summarised as key outcomes for:

- **Air** - Road traffic is the major contributor to air pollution. Exhaust emissions also have a cumulative impact on this component in the polluted air basins in Bulgaria, identified by EEA (Environment Executive Agency).

  The projects proposed in GTMP have a positive impact on air, since their implementation will improve the infrastructure, which in turn will allow an optimal regime of vehicles traffic, reducing at maximum the release of harmful emissions. Re-location of the heavy transit traffic away from the settlements, through construction of bypass road routes, is the best way to reduce the air pollution in them, and particularly, where there are additional loads of industrial emissions.

  The risk of negative impact on air can be considered admissible.

- **Water –** effects on surface water and groundwater are not associated with the capacity or use of transport, neither is it related to the generation of wastewater.

  Any contaminations that could occur would be as a result of incidental events, careless attitude towards technology discipline or a lack of control on the owners and/or users of transport traffic in all its forms - motor vehicles, railway rolling stock, ships and aircraft.

  Overall a negligible negative impact can be expected.

- **Geological base –** along the alignment of construction of new infrastructure facilities, the geological base will be destroyed.

  However transport infrastructure is composed mainly of surface linear engineering facilities (tracks), which have a very small width and therefore, they affect a very small area of land.

  Construction and operation are not related to the use of underground resources, valuable mineral resources or large-scale activities related to damage of ground surface or operations in the geological base depth.

  More serious impacts could arise only in tunnel operations, which have not been identified in GTMP, in fact they have been rejected, as less acceptable (the tunnel under Shipka Pass).

  The impact can be considered admissible.

- **Lands and soils** - in construction of new infrastructure facilities, the land and soils within the route alignment are destroyed, and those within the adjacent strip are changed or damaged.

  Since the linear engineering facilities (tracks) have a small width and therefore affect a small area of land, the impact can be considered negligible. Re-cultivation projects in the affected areas will further reduce the adverse impact imposed.

  The impact can be considered admissible.

- **Landscape** - In any type of construction, including transport infrastructure, the landscape is changed. Even if the nature of the landscape is not fundamentally changed, the new infrastructure has an impact on the visual scope.

  In any project implementation, the visible negative impacts will be mitigated by planting adapted to the newly created conditions and landscapes.

  The impact can be considered admissible.

- **Biological Diversity – Flora** - in the projects' implementation, during the construction of major road and rail infrastructure, vegetation will be destroyed along the route track and in the adjacent strips of land. The same negative impact is imposed on areas bordering construction, particularly where it crosses forest areas.

After the construction works are completed, appropriate re-cultivation and landscape projects, will reduce the initial negative impacts.

As a whole, the impact of the projects proposed, in meeting the set out measures, can be considered admissible.

- **Biological Diversity - Fauna** - construction works will have a high negative impact on fauna, destroying its habitats and displacing other animal species, due to their harassment.

  After construction and commissioning of the linear transport structures, a secondary succession of animal species could occur, as well as the creation of new habitats in the re-cultivated lands within the adjacent areas.

  The most serious outcome of the infrastructure projects is the fragmentation of habitats, which could be significantly reduced by construction of appropriate facilities for animal crossings.

  Using the best practices, following the specialists recommendations, combined with the model for defining the problem sections for various animal species, it will be possible to acceptably mitigate the negative impact of transport on this component.

- **Protected areas and protected territories** - the GTMP projects will only be implemented when regimes for management of protected areas and territories, declared by the Ordinances on their designation and the associated management plans are in place.

  For this purpose, the Biological Diversity Act requires that within the compatibility assessment procedure, a compatibility assessment of the specific investment proposals, plans, projects and programs should be performed.

  The legislation envisages that the expected adverse impacts on protected areas could be reduced, restricted or prevented by implementing a specific mandatory set of measures.

  In cases where projects have exceptional public interest, despite the significant damages to protected areas, their implementation is acceptable if adequate compensatory measures are undertaken, prior to their construction.

- **Cultural-Historical Heritage** - The main impact on historical-cultural heritage arises at archaeological sites during construction. Often the archaeological sites are not registered at the initial stage of construction. Meeting the established requirements for review of sites by archaeologists and their presence during the period of construction, will provide for the identification and survival of archaeological artefacts.

  In compliance with all requirements set by the regulations and meeting the recommendations at EIA level, the impact of transport and in turn of the GTMP can be considered admissible.

- **Population and human health** - any project that leads to a reduction in transport loading in cities, where the noise impact and air pollution is the most sensitive and has the most severe impacts on the population, can be regarded as positively affecting human health.

  The GTMP proposes some options to re-locate heavy transit traffic beyond the settlements, as well as the implementation of new projects, using noise protecting screens to reduce the noise impact on populated areas of settlements.

  The noise impact by GTMP implementation can be considered admissible, on condition that routes in close proximity to recreational and treatment areas are avoided, where the installation of noise protecting screen cannot be ensured.

- **Risk of incidents** – to a large extent the GTMP is aimed at improving existing and constructing new and modern transport infrastructure, compliant to modern requirements, which will reduce the risk of accidents, involving transport vehicles.

  The educational programs and information solutions proposed as part of the GTMP will also reduce the risk associated with human factor.

  The GTMP has a distinctive positive impact on the risk of accidents in any aspect.

- **Material assets** - the priority projects for transport development will result in construction of modern infrastructure objects and facilities, some of which are material assets with an ecological use (systems for treatment of port waste, envisage of passes for animals, etc.).

Overall, the impact on material assets, in compliance and implementation of the measures set out in the EA, can be summarized as positive.

- **Waste** - transport infrastructure is not relevant to this component except during construction, where the excavation works and identification of disposal sites for the dug earth and rock masses need to be fixed. As long as there are many sites, such as abandoned quarries, the disposal cannot be regarded as a serious environmental problem.

  Wastes are not generated as a result of transport operation.

  Transport is not a source of permanent waste, by types and quantities. In meeting the requirements of the Traffic Act, the will be a requirement for the regular cleaning of infrastructure facilities and technological requirements for collection of waste from ships, cars or railway rolling stock, related to transportation of different types or quantities of waste. As a result the impact of waste can be defined as admissible.

- **Transportation of dangerous goods** - the use of reliable transport vehicles, meeting the requirements for transportation of dangerous goods and the control of loading-unloading operations, will reduce the potential for adverse impacts on the environment, due to accidents and incidents.

  The GTMP identifies the requirement for modernisation of transport and infrastructure, which will indirectly have additional positive impacts in reducing the risk of incidents with dangerous goods.

- **Harmful physical factors** - the main adverse transport impact is caused by the operation of transport infrastructure.

  There are many possibilities and methods to reduce the noise load in the regions of road routes. In designing the necessary noise protecting screens, impacts can be reduced to admissible load levels, in compliance with the appropriate regulations.

  The incorporation of appropriate noise protection facilities in to the designs of GTMP projects there will be a significant impact resulting from this component.

9.8.5.2 Mitigation

Measures envisaged to reduce (prevent, reduce and offset) the impact on the environment are addressed at two levels. Firstly, a number of measures are proposed for inclusion in the final version of the GTMP. Secondly, a number of steps were recorded to be taken into account when transport infrastructure is at a stage of more detailed development and construction. These proposals are presented in Chapter 7 of the EA report. The proposed measures for mitigation are shown as part of the MoE&W's EA standpoint № 1-1/2010, presented in section 9.8.7 of this report.

9.8.5.3 Monitoring Proposals

As previously stated there is a requirement that the EA report must include details on how the environmental impact of GTMP will be monitored during the full implementation of the plan. The purpose of the monitoring is to ensure that the plan is implemented as intended and to identify unexpected environmental impacts. This also allows for corrective action if necessary. The proposed measures for monitoring are shown as part of the MoE&W's EA standpoint № 1-1/2010, presented in section 9.8.7 of this report.

9.8.6 Consultations

9.8.6.1 Scoping

The Directive requires a number of formal consultations with designated environmental authorities. In Bulgaria's case, the environmental legislation is that of the Ministry of Environment and Water.

The Directive states that the MoE&W *shall be consulted when deciding on the scope and level of detail of the information which must be included in the environmental report.*

The Scoping Report was submitted to the MoE&W in July 2009.

9.8.6.2 Appropriate Assessment

The European Birds Directive (79/409/EEC) and Habitats Directive (92/43/EEC) are the main mechanisms for the protection of species (including birds) and habitats across all Member States of the European Community. These Directives have resulted in the establishment of a pan-European network of protected sites often referred to as the 'Natura 2000 Network'. In addition to these protected sites the Directives provide for the protection of rare (in a European context) habitats.

In relation to Natura 2000 sites, Article 6 of the Habitats Directive requires that any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to an appropriate assessment of the compatibility of the predictions of the plan with the object and purpose of conservation of the protected area.

Due to the scale of the GTMP and the locations of schemes within it, it was necessary to consult with the MoE&W to determine whether an 'appropriate assessment' of effects on Natura sites would be required. The MoE&W response to the need for assessment of compatibility is:

> *"Given that the GTMP has a national scope, it is likely that its implementation will affect protected areas under the law for protected areas as well as protected ecological areas of the Natura 2000 network.*
>
> *In this regard, an eligibility check was executed under Art. 36, item 2 from the Regulation on the conditions and procedures for assessment of the compliance of plans, programmes, projects, and investment proposals with the objectives and goals for preservation of protected areas (The Regulation, SG 73/2007). The eligibility check found that the GTMP is eligible, if the resulting programmes, projects and investment proposals comply with:*
>
> - *The regimes of protected areas set by the Law for Protected Areas,*
> - *The orders that announced them and the confirmed management plans,*
> - *The regimes of protected areas set by the orders under Art. 12, item 6 from the Law for Biodiversity.*
>
> *In compliance with Art. 36, item 3 from the Regulation stated above, an assessment of the possible level of adverse impact was undertaken, according to which the GTMP is not likely to have significant adverse impact on natural habitats, populations and habitats of species that are under protection in the protected areas from Natura 2000 for the following reasons:*
>
> - *The GTMP does not deal with particular projects or investment proposals, but sets out an overall framework for improvements in the quality of the country's transport infrastructure;*
> - *The majority of the specific projects included in the long list of options for the different modes either have a completed assessment of compliance with the objectives and goals for protection of areas for the Natura 2000 network or are in the process of having one prepared;*
> - *An analysis of the current condition of transport was made and the shortfalls of the infrastructure and the activities for the different modes were detected based on economic, social and environmental aspects; and*
> - *The GTMP complies with other national plans, programmes and strategies on environmental protection and in particular biodiversity and it does not contradict the principles set out in them."*

Therefore, on the advice of the MoE&W, an appropriate assessment of compatibility has not been undertaken for the GTMP.

9.8.6.3 Environmental Report

Following completion of the environmental assessment, the Directive states that both the MoE&W and the public must be *given an early and effective opportunity within appropriate time frames to express their opinion on the draft plan or programme and the accompanying EA report before the adoption of the plan or programme or its submission to the legislative procedure.*

The EA Report and draft GTMP were submitted to the MoE&W in December 2009. The two reports were also published on the Ministry of Transport's website between December 2009 and January 2010, to enable comments from the public.

9.8.6.4 Transboundary Consultation

In respect of transboundary consultation, the Directive states that w*here a Member State considers that the implementation of a plan or programme being prepared in relation to its territory is likely to have significant effects on the environment in another Member State, or where a Member State likely to be significantly affected so requests, the Member State in whose territory the plan or programme is being prepared shall, before its adoption or submission to the legislative procedure, forward a copy of the draft plan or programme and the relevant EA report to the other Member State.*

The GTMP was not considered likely to result in significant effects on neighbouring Member States; therefore no transboundary consultation was undertaken.

9.8.7 *Standpoint of the Ministry of Environment and Water (Opinion № 1-1/2010)*

The views of the Minister of Environment and Water were taken into account while developing the final report of the GTMP and all measures and conditions from the Minister's Standpoint will be executed during the implementation of the plan. The text of the Standpoint is:

The Ministry of Environment and Water, on the basis of Article 26 paragraph 1, point 1 of the Regulation for procedures and the order for conducting environmental assessment of plans and programs in conjunction with Article 31 of the Biodiversity Act and Article 37, paragraph 4 of the Regulation for procedures to assess the consistency of plans, programs, projects and investment proposals with the object and purpose of conservation of protected areas, **APPROVE** the General Transport Master Plan on the following grounds:

1. The **main objective** of the General Transport Master Plan is the establishment of a strategic and coherent base of technical data, transport models, multimodal technical studies for **project identification for long and medium term investment programming in the transport sector in Bulgaria**.
2. The primary environmental objective of the plan is **Sustainable transport development**:
   - Balance the development of different modes of transport by increasing the share of rail transport, aimed at limiting the harmful emissions by transport;
   - Integrate the environmental requirements in the plans, programs and projects for transport development;
   - Limit the noise load in populated areas and its adverse effects on their inhabitants, through the allocation of transit traffic on to bypass routes;
   - Reduce the water and port areas pollution from ships, through auditing of general master plans, in terms of compliance with the environmental requirements, and introduce a waste management system.
3. Prioritisation of projects proposed in the plan was made based on a multi-criteria analysis, including criteria and indicators for impacts on the environment.
4. Conditions and measures for prevention, mitigation and fullest possible elimination of eventual adverse effects from the implementation of the GTMP, were from recommendations within the environmental assessment (EA) and from consultations.
5. In compliance with Art. 36, item 3 from the Regulation for environment, an assessment for the possible level of adverse impact was executed, according to which the GTMP is not likely to have significant adverse impact on natural habitats, populations and habitats of species that are under protection in the protected areas from Natura 2000 for the following reasons:
   - The GTMP does not deal with particular projects or investment proposals, but sets out an overall framework for improvements in the quality of the country's transport infrastructure.
   - The majority of the specific projects included in the long list of options for the different modes either have a completed assessment of compliance with the objectives and goals for protection of areas for the Natura 2000 network or are in the process of having one prepared.
   - An analysis of the current condition of transport was made and the shortfalls of the infrastructure and the activities for the different modes were detected based on economic, social and environmental aspects.
   - The GTMP complies with other national plans, programmes and strategies on environmental protection and in particular biodiversity and it does not contradict the principles set out in them.
6. In the course of preparing the environmental assessment report the results from the consultations held were appropriately motivated and integrated. The EA report was published on the website of the OPT for a period of 20 days for the purpose of consultation with the public and stakeholders. No written negative standpoints were received from stakeholders. Also no different information from that presented in the EA report was received or information which was contrary to the following measures and conditions:

I. Measures, envisaged to prevent, reduce and most efficiently compensate the adverse impacts on the environment, resulting from the implementation of the Plan

A. Measures to be included in the Final GTMP version

1. The projects, providing investment proposals/plans, for which EIA/EA is required (under EPA) and/or assessment for compatibility (CA) of the project with the object and purpose of

preservation of protected areas, which are likely to be affected, must only be approved after a positive EIA/EA opinion and/or CA decision, and after meeting the recommendations in the assessments made and in the decisions and opinions presented.

2. Options for project locations will be considered which are consistent with the legislation for protected areas and protected territories, preservation of Cultural Historic Heritage (CHH), meeting the requirements for Hygiene Secured Areas (HSA) and Sanitary Secured Areas (SSA), avoiding additional load on the air in Regions for Air Quality Assessment and Management (RAQAM).
3. Preferred options selected will minimise impacts on the hydro-morphological conditions of water bodies. If possible, options affecting riverbeds and those passing near dams, marshes and lakes should be avoided.

B. Measures to be considered in the development of GTMP priority projects

1. In studying routes and the choice of alternatives for the location of road infrastructure and the impact of the spread of emissions, whenever possible, maximum distance should be kept from settlements.
2. The activities planned in the GTMP should comply with the programme of measures to achieve good quality of water bodies in the plan for river basin management, relevant to the respective basin region.
3. In selection of options for implementation of the relevant priority projects, schemes should be chosen that result in the expropriation of unproductive agricultural land (above category V) and low productive soils, and if possible avoid forest lands.
4. Develop and implement infrastructure projects with appropriate landscape design.
5. At the stage of feasibility studies, before choosing of an alternative, the following should be considered:
   - Carry out surveys of flora within the boundaries of those routes where the construction of transport infrastructure and facilities are planned.
   - Use the information from the surveys of flora in the ongoing monitoring of forest ecosystems and the health status of forest ecosystems and biodiversity.
   - Avoid protected zone areas.
   - Avoid routes through areas occupied by highly productive forests, resistant to harmful influences.
   - If necessary, select a new route, in order to preserve protected species, which should include:
     - *identifying habitats and declaring them as protected*
     - *organising effective measures for their protection*
   - Observe restrictive construction lines, to avoid further damages on terrains and their vegetation. Within the specific investment plans measures should be provided, where necessary, for relocation of individual protected plant species and their planting in appropriate areas. Provide compensatory programs for any destroyed vegetation.
   - In the design of priority road and rail transport projects, suitable sites should be studied and facilities considered for the safe passage of wildlife.
   - In proceeding of EPA investment proposals, related to the operation of the Danube as a waterway, prior monitoring should be prepared by ichthyobiologists to identify the breeding/ reproductive areas (areas for caviar discharge) of sturgeon and other protected fish and provide concrete measures for their protection in dredging works.
6. Plan and implement appropriate noise protection screens for relevant projects, based on the expected noise levels.
7. Explore and identify suitable sites for the disposal of dredging masses, before commencing the dredging works to improve the navigation on the Danube River and navigational activities in the ports of Burgas and Varna.
8. Regular cleaning and maintenance of road infrastructure, including road drainage facilities, must be carried out.

II. Measures for monitoring and control when implementing the General Transport Master Plan

1. Ministry of Transport, Information Technology and Communications should prepare a report on monitoring and controlling to be undertaken during implementation of the General Transport Master Plan, including measures to prevent, reduce or eliminate environmental damage resulting from the implementation of the Plan that should be presented in MoE&W (Directorate "Preventive Activities") not later than 15 April **of every third year.**
2. Monitoring and controlling the environmental impacts from implementation of the Plan should be executed based on the following measures and indicators:

Table 9.9 – Monitoring of Environmental Impacts

Subject of monitoring and control	Impact indicators	Measure	Controlling Agency
Atmospheric air	Changes in greenhouse gas emission quantities from transport (emissions of CO_2, N_2O and CH_4 from transport)	Tonnes	EEA (Executive Environmental Agency)
	Change of emissions of air pollutants (particulate matter PM10, PM 2.5, SOx, NOx, hydrocarbons – CH_4 and methane) in RAQAM (Regions for air quality assessment and management)	$\mu g/m^3$	EEA, RIEW
	Change in proportion of goods transported by road/rail transport	(%)	MTITC
Water	SSA involved around aquatic objects	units, area ha	Basin Directorates
	Changes to riverbeds for transport infrastructure purposes	Length, m	Basin Directorates
	Pollution events causing contamination of water bodies, plus measures taken to mitigate and/or eliminate the effects	units	Commissions in RAFDs (Regional Agriculture and Forests Directorates), RIEW
	Pollution events causing contamination of water bodies, plus measures taken to mitigate and/or eliminate the effects	mg/l	Black Sea Basin Directorate
	Cases of deviation from good water condition in port areas	%	Black Sea Basin Directorate
Geological base	Technical measures implemented to ensure stability of slopes against landslides, erosion reinforcement of slopes and preventing soil layers from erosion.	units	Expert Technical-Economic Council т (ETEC) in Road Infrastructure Agency
Land and soils	Type and method of expropriated land use for construction of transport infrastructure facilities	Land category, method of land use	Commissions of the regional directorates for agriculture and forests, contracting authorities
	Emergency spills of hazardous substances and petroleum products, causing soil contamination	units, area	RIEW

Subject of monitoring and control	Impact indicators	Measure	Controlling Agency
Landscape	Change in the ratio of natural/ urbanised landscapes, due to transport	%	RIEW, Municipalities
Flora	Impact on habitats of protected plant species	Under the approved National Biodiversity Monitoring System	Relevant RIEW, EEA (Executive Environmental Agency)
	Habitats of protected animal species	%	
	Removed plant cover	m^2	
Fauna	Impact on habitats lost supporting protected animal species	Under the approved National Biodiversity Monitoring System	Relevant RIEW, EEA
	Number of populations	units	
	Animal mortality from collision with motor vehicles	units	
Protected areas and protected territories included in them	Integrity and coherence of the areas. Condition of the natural habitats. Condition of the habitats of species. Population characteristics of the species.	Under the approved National Biodiversity Monitoring System	MoE&W, RIEW
	Fragmented habitats	ha area % of PA and PT	
	Transport infrastructure sites close to Protected areas and Protected territories	m	
Cultural-heritage sites	NHH and NCH sites affected by construction of transport infrastructure and facilities	units	National Institute for Immovable Cultural Heritage, Institute of Underwater Archaeology
Risk of accidents	Number of accidents for different transport modes, related to transport	units	NSI, relevant commissions in MTITC
Material assets	Constructed facilities with ecological functions (water treatment facilities, passage facilities for animal movements and restored ecological corridors, etc.)	units, type	MTITC, relevant RIEW
	Condition of transport infrastructure assets	extent	MTITC
Waste	Approved plans for port waste management	units	RIEW, Ports
	Constructed waste treatment facilities	units, capacity	RIEW

Subject of monitoring and control	Impact indicators	Measure	Controlling Agency
	Ratio of the generated mass and disposed dredged masses	%	RIEW, Basin directorates
	Sites designated for disposal of dredged mass/capacity	dca; m^3	RIEW, Basin directorates
Noise	Noise loading in populated areas	dB(A); % of the noise norm	EEA
	Noise protection measures	units	Relevant RIEW and RICPPH

3. When adverse environmental effects were found, timely measures to eliminate them must be suggested and undertaken.

9.9 Sensitivity Tests

9.9.1 *Higher/Lower Economic Growth*

The evidence from the current economic crisis in Bulgaria and across the rest of Europe and the world is that irrespective of trends and of the forecasts of the most eminent of economists there is no way of predicting how the global economy will perform and that there are likely to be significant fluctuations particularly in short term time horizons.

As a result it is important to understand how robust the Master Plan will be in circumstances where growth in the economy is lower than or higher than the central estimate derived to reflect the most likely outcome. **Table 9.10** below shows the difference in predictions for population and GDP that underpin the forecasts for the low, central and high growth forecasts.

Table 9.10 – Sensitivity Test Population and GDP Forecasts

	Economically Active Population			GDP (% Growth from 2008)		
	Low	Central	High	Low	Central	High
2008	3,636,238	3,636,238	3,636,238	-	-	-
2015	3,423,958	3,516,678	3,581,641	+10.17%	+17.36%	+21.44%
2030	3,042,367	3,198,682	3,352,347	+94.62%	+128.10%	+146.48%

Table 9.13 presents the results of low and high growth tests for the Master Plan Strategy as reflected by the principal infrastructure investment projects for road and rail.

The results demonstrate that whilst the individual elements of the CBA change as might be anticipated with the different growth assumptions (e.g. travel time and other benefits are highest with high growth and lowest with low growth) the net effect of the total value of the benefits is small and consequently the impact on Net Present Value and Benefit to Cost Ratio are also small. Whilst this does not reflect the impact that would be felt when looking at all criteria and objectives for all individual schemes it can be used to demonstrate that divergences in the outturn economic indicators from the central “most likely” estimate should not materially impact on the value and viability of the overall Master Plan.

9.9.2 *Impact of a Mode Focussed Strategies*

For comparative purposes it is also useful to present the results for a strategy which emphasises investment in one or other of the principal transport modes. **Table 9.13** presents the results for a strategy

which comprises of all the roads schemes in combination and all the rail schemes in combination, assuming the central growth forecasts.

This shows that on the basis of the monetised cost benefit appraisal the highway schemes return better results than the rail schemes. The value of the combined benefits is somewhat lower than the average of the individual schemes because of the competition between schemes.

The final test in **Table 9.13** is a sensitivity test for rail schemes in combination. In the transport model there is an inbuilt time penalty built in to the model algorithms to reflect the current very low view taken of rail transport because of its poor image, quality, journey ambience and reliability. This was used in the model during the calibration phase to ensure the model properly reflected passengers' perception of rail travel and the deterrence to its use.

The sensitivity test for rail with the penalty for travel removed is to reflect a situation where the quality of the rail travel experience for passengers is significantly enhanced to reflect not only the infrastructure schemes being proposed but also the proposed upgrading of rolling stock and passenger facilities. The results of the test show a significant improvement in the cost benefit results for all rail schemes combined with a benefit to cost ratio increasing from 0.68 to 0.75.

Table 9.11 - Master Plan Assessment Summary

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT (combined road & rail projects)	QUALITATIVE ASSESSMENT
Strategic, Policy and Legal	Creation of Trans-European Network	Significant contribution to the ongoing development of the Trans-European Network through improvements along all TEN-T corridors in Bulgaria, comprising highway, railway, waterway and inter-modal schemes and complementary network management measures	453 km of new/ improved highway and 1,150 km of improved railway on the TEN-T network.	Highly Positive
	Development of intermodal transport	Significant contribution through enhancement to rail and water networks, facilities and services linked to specific inter-modal terminal proposals		Highly Positive
	Development of sustainable transport	Major investment is recommended across all modes of transport with a strong emphasis on rail transport and in inter-modal facilities which will benefit all strategic passenger/freight transport.		Positive
	Development and maintenance of the transport infrastructure and capacity	The plan recognises and addresses both the lack of capacity in the existing transport systems and the poor record of infrastructure maintenance		Highly Positive
	Enhance the regional tourism potential	Proposals for new and improved transport infrastructure to support enhanced movement of people to and within Bulgaria will significantly improve accessibility to regional tourism locations		Positive
Economic and Financial	Capital and Net Operating Expenditure	The projects within the Master Plan will be available for funding through many different channels, including the SOPT/SOPRD both current and future programmes, loans from the European Investment Bank and the World Bank, State and Municipal Funds, the private sector and PPP	€5.920 bn	N/A
	Transport Economic Efficiency: Passengers	Significant transport economic efficiency benefits for passengers using all modes of transport. Just as important is the improved reliability of journey time across highway and rail especially through better management and maintenance regimes.	Travel Time Savings €7.4bn / Vehicle Operating Costs €1.2bn	Highly Positive
	Transport Economic Efficiency: Freight	Significant transport economic efficiency benefits for movement of freight using all modes of transport through reduced journey time and improved reliability	Rail Freight Operating Cost Savings €925m	Highly Positive
	Capacity	The plan will significantly increase the carrying capacity of all modes of transport to levels that are commensurate with the forecasts of future transport demand		Highly Positive
Social Criteria	Accessibility for the socially disadvantaged	Those elements of the plan which will provide accessibility to improved public transport services will be of benefit to those without access to a private car and on limited incomes		Positive
	Creation and support of employment opportunities	Planning, design and construction will create new jobs, some temporary and some permanent. The availability of improved services will give people better access to employment opportunities		Positive
	Support for the urbanisation of towns and cities other than Sofia	The plan is national in its geographic coverage and the improved transport efficiency brought to all parts of Bulgaria will support urbanisation of towns and cities other than Sofia		Positive
Environment (see KR9 for more details)	Biodiversity	The plan overall and the highway infrastructure projects in particular has the potential to have adverse impacts on bio-diversity including protected sites and species. Impacts will be reduced through appropriate design and mitigation.		Negative

OBJECTIVE	SUB-OBJECTIVE	QUALITATIVE IMPACTS	QUANTITATIVE ASSESSMENT (combined road & rail projects)	QUALITATIVE ASSESSMENT
	Water Environment	The plan overall and the highway infrastructure projects in particular has the potential for adverse affects on water quality of adjacent water bodies through increased run-off, pollution during construction and during operation of the road. Impacts will be reduced through appropriate design and mitigation.	Soils and Water Pollution € -22.2m	Slightly Negative
	Soils & Material Assets	The plan overall and the highway infrastructure projects in particular has the potential for loss and fragmentation of agricultural land. Impacts will be reduced through appropriate design and mitigation.		Slightly Negative
	Landscape	The plan overall and the highway infrastructure projects in particular has the potential for adverse affects on landscape/townscape character and visual amenity. Impacts will be reduced through appropriate design and mitigation.	€ - 254m	Negative
	Cultural Heritage	The plan overall and the highway infrastructure projects in particular has the potential for adverse affects on protected historic features and archaeology either through direct affects on these features or on their setting. Impacts will be reduced through appropriate design and mitigation.		Negative
	Population & Human Health	Diverting traffic away from settlements will have positive benefits in terms of reduced noise impacts for residents and improved air quality. However, the increase in vehicle kilometres resulting from increased economic activity will have an overall negative impact outside cities. However unquantified rail reliability improvements will encourage greater use of sustainable modes and mitigate this impact.	€ - 44m	Neutral
	CO_2 Emissions	The highway schemes in the plan will lead to a combination of increased kilometres being generated by existing users and further kilometres as a result of new trips. This impact however is mitigated by the beneficial impacts associated with modal transfer resulting from the rail investment projects.	€ - 222m	Negative
Safety and Security	Accidents	Benefits of accident savings resulting from transfer of traffic from road to rail and water and from transferring road traffic to higher quality and safer roads is outweighed by the effects of road traffic generation and changed distribution resulting from the lower costs of road travel. This will be addressed through proposals for new road safety initiatives which have not been quantified.	€ - 313m	Slightly Negative
	Security	Proposals within the overall plan to address management, administration and operations and for improved facilities for travellers using public transport will have a beneficial impact on security		Slightly Positive
Fundability	Likelihood of receiving EU, national or private funding	Most of the major capital investment projects for transport infrastructure lie on TEN-T corridors and conform to EU objectives for transport development within community member countries and therefore will be eligible for EU funding. Other projects that meet national transport and economic development objectives should be strong candidates for state funding. Investments where the primary beneficiaries are likely to be private organisations will attract private funding if they are considered by potential investors as being financially viable		Positive
Deliverability	State of preparation of the scheme	Many of the projects within the overall plan, particularly the major infrastructure investment projects in road and rail have been in development for a significant period and scheme preparation is well advanced. This will allow priority projects to be confirmed and delivered with the minimum of delay		Positive
Risk	Assessment of risk on schemes performance and capital and operating costs	All projects are at risk of delay or cancellation, however, the Master Plan comprises of a significant number of projects allowing schemes which may be ranked lower in terms of priority to be advanced and delivered if other schemes are delayed or cancelled for whatever reason. Overall risks to the overall plan are relatively small.		Slightly Negative

Table 9.12 - Cost Benefit Analysis for Individual and Combined Major Infrastructure Projects

No	Scheme Name	Travel Time Savings	Accident Impacts	Rail Revenue (taken as cost saving)	Freight/ Vehicle Operating Cost Benefits	Environ-mental external costs	Noise Emission Costs in Road Transport	Nature and landscape costs	Soils and water pollution costs	Capital Costs	Operating Costs	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
Highway Schemes															
H08	Trakia – Stara to Karnobat	2,039,546	-134,152	N/A	417,392	-76,051	-16,674	-70,753	-8,433	286,557	97,672	2,150,876	384,229	1,766,647	**5.60**
H10	Hemus - Sofia R.R. to Yana	120,239	5,128	N/A	17,036	-2,382	-523	-5,230	-264	24,526	7,219	134,005	31,746	102,259	**4.22**
H11	Hemus – Yablanitsa to Shumen	1,705,463	-158,267	N/A	104,041	-72,549	-15,933	-141,506	-8,053	971,020	195,343	1,413,197	1,166,364	246,833	**1.21**
H12	Maritsa – Chirpan to Harmanli	274,239	54,544	N/A	-6,006	-5,806	-1,274	-41,837	-644	170,788	56,730	273,216	227,518	45,698	**1.20**
H13	Black Sea – Burgas to Priseltsi	659,511	24,203	N/A	202,475	-14,977	-3,275	-58,448	-1,658	327,494	80,685	807,830	408,179	399,651	**1.98**
H14	Struma – Dolna Dikanya to Kulata	817,745	139,595	N/A	135,078	-12,178	-2,658	-84,904	-1,347	491,241	117,206	991,331	608,447	382,883	**1.63**
H15	Sofia Ring Road North Arc	718,252	49,913	N/A	-63,840	-6,436	-1,417	0	-715	82,160	18,940	695,757	101,100	594,657	**6.88**
H16	Sofia Ring Road South Arc	1,094,066	-32,472	N/A	-65,578	-11,328	-2,504	0	-1,261	44,921	6,564	980,922	51,484	929,438	**19.05**
H17	Rila – Dupnitsa to Hemus	607,110	112,441	N/A	-27,376	-14,509	-3,174	-7,959	-1,607	182,169	26,552	664,925	208,721	456,204	**3.19**
H19	I-1/E79 – Botevgrad to Dimovo	279,746	24,464	N/A	-23,661	-5,970	-1,298	0	-659	88,423	20,047	272,623	108,470	164,153	**2.51**
H23 b	I-5/E85 – Ruse to Makaza via N Zagora	851,047	-121,029	N/A	302,720	-20,962	-4,588	0	-2,322	375,720	98,937	1,004,867	474,657	530,210	**2.12**
Railway Schemes															
R12	Sofia - Vidin	165,897	635	28,553	67,955	59	1,287	0	651	428,199	0	236,483	399,646	-163,162	**0.59**
R13	Sofia - Plovdiv - Burgas & Varna	513,989	1,828	166,270	289,995	180	3,967	0	2,001	806,377	368,303	811,960	1,008,410	-196,450	**0.81**
R14	Sofia to Kulata	90,331	259	2,170	59,511	25	544	0	275	234,977	0	150,945	232,808	-81,862	**0.65**
R21	Sofia - Gorna - Varna	443,934	1,511	153,732	108,927	141	3,089	0	1,559	715,575	198,530	559,161	760,373	-201,212	**0.74**
R23	Ruse - Gorna - Stara Zagora	41,780	225	6,267	40,481	21	457	0	231	167,841	0	83,193	161,574	-78,381	**0.51**
All Highway and Rail Schemes Combined															
	All road and rail schemes	7,438,781	-311,911	201,050	2,106,300	-201,247	-44,045	-253,945	-22,207	4,965,929	1,154,875	8,711,726	5,919,754	2,791,972	**1.47**

Note : All figures are in € ,000's at 2009 Figures and Prices discounted to 2009

Table 9.13 - Cost Benefit Analysis for Sensitivity Tests

No	Scheme Name	Travel Time Savings	Accident Impacts	Rail Revenue (taken as cost saving)	Freight/ Vehicle Operating Cost Benefits	Environ-mental external costs	Noise Emission Costs in Road Transport	Nature and landscape costs	Soils and water pollution costs	Capital Costs	Operating Costs	Present Value of Benefits (PVB)	Present Value of Costs (PVC)	Net Present Value (NPV)	Benefit to Cost Ratio (BCR)
Higher Economic Growth															
	High Growth	7,584,152	-319,882	206,306	2,096,660	-203,630	-44,282	-253,945	-22,374	4,965,929	1,154,875	8,836,699	5,914,499	2,922,201	**1.49**
Lower Economic Growth															
	Low Growth	7,248,734	-279,764	196,154	2,123,259	-194,571	-42,882	-253,945	-21,693	4,965,929	1,154,875	8,579,138	5,924,650	2,654,487	**1.45**
All Highway Combined															
	Highways Combined	6,776,495	-314,557	N/A	1,182,220	-201,519	-44,127	-253,945	-22,279	2,969,852	588,042	7,122,289	3,557,894	3,564,395	**2.00**
All Railway Schemes Combined															
	Railways Combined	665,368	2,371	204,279	924,631	228	50	0	25	1,996,077	566,833	1,592,674	2,358,632	-765,958	**0.68**
All Railway Schemes with Penalty for Travel Removed															
	Rail without Penalty	789,416	3,241	276,225	924,558	307	67	0	33	1,996,077	566,833	1,717,621	2,286,686	-569,065	**0.75**

Note : All figures are in € ,000's at 2009 Figures and Prices discounted to 2009

9.10 Priority Projects

It is a particular requirement of the Master Plan project to recommend projects that can be developed and delivered in the short-term, in particular those that can be brought forward within the period of the current Operational Programme for Transport covering the years 2007 to 2013.

The priority projects selected cover management, corridor and network interventions and their choice reflects them meeting a number of basic key criteria:

- Meet an urgent need identified in the review of issues, problems and gaps;
- Conform to the principal objectives set out in Bulgarian and European Transport Strategy documents;
- Support strategic economic objectives;
- Contribute towards integration with European Union member states;
- Can be funded through available and anticipated budgets (EU and State) or will attract private sector funding;
- Can be developed and delivered before 2015;
- Provides an appropriate return on any investment;
- Does not suffer from significant risks to delivery;
- Is part of a balanced strategy which supports alternative and sustainable transport modes and has the potential to improve integration; and
- Does not suffer from any environmental impacts that are either unacceptable or cannot be mitigated.

The detail of how individual elements within the Master Plan meet these objectives has been detailed in earlier of this report.

Table 9.14 provides the list of projects within the overall Master Plan which are recommended for priority development and delivery.

Table 9.14 - Priority Projects

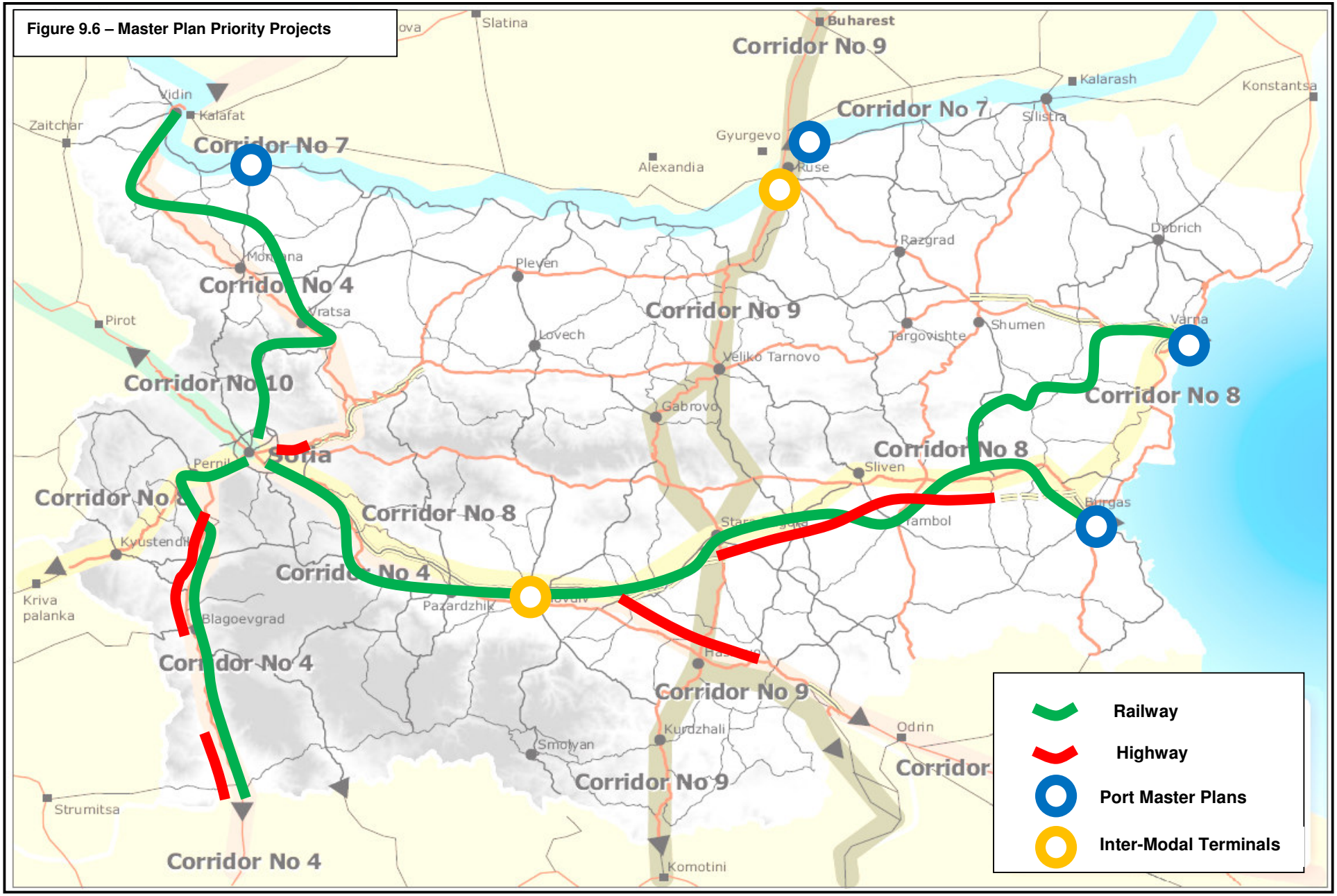
Option No.	Option Title	Option Type		
		Management and Administration	Corridor Strategies	Network Strategies
Highways				
H01	Review of roads Infrastructure administration and network Hierarchy	X		
H02	Review of highway funding and charging	X		
H03	Network maintenance plan and network asset condition monitoring			X
H05	Development of a Road Safety Information and Education Campaign			X
H08	A1"Trakia" Motorway Stara Zagora to Karnobat		X	
H10	A2"Hemus" Motorway Sofia ring Road to Yana		X	
H12	A3 "Maritsa" Motorway		X	
H14	A6 "Struma" Motorway		X	
Railways				
R01	Review of railway administration	X		
R02	Review of railway funding and charging	X		
R03	Network, station and freight facilities rationalisation			X
R09	Upgrading of rail passenger information			X
R12	Renewal and upgrade Vidin to Sofia		X	
R13	Renewal and upgrade Sofia - Plovdiv – Burgas/Varna		X	
R14	Renewal and upgrade Sofia to Kulata		X	

Option No.	Option Title	Option Type		
		Management and Administration	Corridor Strategies	Network Strategies
Water Transport				
W04	Review of management of concession procedures (all ports)	X		
W10	Development of Phase 3 vessel traffic management information system			X
W12	Development of a real-time Information System for the Danube River		X	
W14	Port Varna – review of master-plans and development strategy		X	
W26	Port Burgas – review of master-plans and development strategy		X	
W41	Port Lom - review of master-plans and development strategy		X	
W47	Port Ruse - review of master-plans and development strategy		X	
Air Transport				
A01	Airport Charges	X		
A02	Air Market Study (Central and Northern Bulgaria)			X
Inter-Modal Transport				
IM01	Plovdiv Inter-Modal Terminal		X	
IM02	Ruse Inter-Modal Terminal		X	
IM03	Public Transport Interchange			X

Figure 9.6 shows the priority infrastructure projects that are geographically specific.

The total combined capital and operating costs associated with the major infrastructure projects in the priority list is approximately €2.9bn of which 45% is associated with highway projects. Whilst the total is in excess of the monies available from the current OPT (€2bn), the balance could be made up from State co-financing and through private sector investment.

Figure 9.6 – Master Plan Priority Projects



10 Master Plan Delivery

10 Master Plan Delivery

10.1 Introduction

The report concludes with a discussion of strategies for delivery of the Master Plan. It summarises the work undertaken in four critical areas which will have an influence on the ultimate level of success of the outcomes from the Master Plan. These areas are:

- An asset maintenance strategy;
- A strategy for implementation and funding;
- A strategy for development of human resources in the transport sector; and
- A strategy for monitoring and evaluation of the Master Plan.

Together they provide a framework for delivery of the Master Plan.

10.2 Asset Maintenance Strategy

10.2.1 The Relevance of an Asset Maintenance Strategy to the success of the Master Plan

As set out in Chapter 9, the General Transport Master Plan includes proposals for the rehabilitation of existing transport infrastructure as well as proposals for new projects. It is essential that the new or rehabilitated infrastructure is maintained so that it can continue to deliver the planned levels of quality and capacity into the future. A key element of the overall Master Plan is therefore the development of a strategy for the maintenance of infrastructure.

From the analysis of the condition of the existing infrastructure it has been possible to determine the shortfall in infrastructure condition. By reviewing both existing and proposed levels of investment in the rehabilitation of the infrastructure it has also been possible to identify any significant shortfalls and determine an approach to developing an appropriate future programme for rehabilitation.

In addition to the rehabilitation of the existing infrastructure, a programme of work needs to be determined to maintain the new infrastructure delivered and those parts of the network not in immediate need of rehabilitation. The infrastructure will deteriorate as it is used and allowance needs to be made to ensure that it receives the appropriate maintenance treatments before significant damage occurs and expensive rehabilitation becomes necessary.

Each of the four principal modes of transport have been considered individually by making reference to existing asset condition and any known programmes for asset maintenance as a context for recommendations for an asset maintenance strategy.

10.2.2 Highways

10.2.2.1 Goals and Objectives

The recommended goals of the road asset management plan are:

- Preservation of the physical integrity of the asset;
- Restoration of the physical integrity of the asset;
- Ensuring the delivery of a network that meets customer requirements for safety, availability, accessibility etc; and
- Demonstrating the needs of the road in competition with other calls on public funds by demonstrating the economic value of carrying out maintenance.

10.2.2.2 The Plan for Existing Infrastructure

The plan for maintenance of the existing infrastructure must include all parts of the road infrastructure:

- Carriageways and footways;
- Road structures, including bridges, footbridges, retaining walls, subways, and culverts;
- Tunnels;
- Lighting and lighting columns; and
- Other assets, including traffic signs, road markings and studs; drainage; street furniture; and the green estate.

The plan must also cover all aspects of maintenance work:

- Cyclical maintenance, for example cleansing, vegetation control, and drainage clearance;
- Winter maintenance, for example snow clearance, salt and sand spreading;
- Routine maintenance; for example pothole patching, crack sealing, concrete repairs; and
- Heavy maintenance, rehabilitation of the pavements, drainage features or road structures.

There will be a series of steps that will need to be taken to establish a successful maintenance plan:

- Implementation of an asset management system including inspection regimes;
- A comprehensive review of the existing asset data and inspection systems;
- Establishment of the current value of the asset to ensure the most economically viable plan for maintenance;
- Define an appropriate short-term budget for cyclical and routine maintenance operations;
- Prepare medium to long term planning estimates of funding needed for maintenance; and
- Utilise the Asset Management System to determine the most economical viable programme of maintenance works.

10.2.2.3 The Plan for New/Upgraded Master Plan Generated Infrastructure

New or Upgraded Master Plan Generated Infrastructure will be integrated in the Asset Maintenance Plan for Existing Infrastructure over time as the new or upgraded assets come into service.

The routine, cyclical and winter maintenance needs of new or upgraded infrastructure must be included in the plans for the existing infrastructure before they enter service because without the necessary routine maintenance being carried out from completion, the service life of the assets will be less than anticipated and the full economic benefits will not be realised.

As part of the evaluation of the design of new or upgraded infrastructure an assessment of the future maintenance costs of the asset must be carried out and the design option with the minimum whole life cost chosen. This option may not be the one with the lowest initial cost. The Asset Management System can be used to assist with this process.

10.2.2.4 Investment in Plant and Equipment

As part of the World Bank funded Road Rehabilitation Project investments are being made in testing and measurement equipment that will assist in determining the optimum future maintenance programmes.

Plant and equipment for maintenance operations is provided by contractors and longer term contracts. Performance based contracts are recommended, which will encourage the contractor to invest in appropriate plant and equipment.

10.2.2.5 Management, Administration and Regulation

At present the management of the Republican Network lies with the Agency for Roads Infrastructure (ARI) and the management of the non-Republican network and the footways of Republican Roads lie with the local Municipality. There are 264 Municipalities.

The introduction of modern maintenance management practice within the small municipalities will be difficult because of their small size and consideration should be given as to how operation of asset management systems can be operated on their behalf.

The current arrangement with a split of responsibilities for Republican Roads in urban areas should be examined to ensure that it ensures the most effective use of resources.

10.2.2.6 Human Resources Implications

The implementation of a new asset maintenance strategy will require education of existing staff or recruitment of new staff with the necessary skills. An education programme for the staff of ARI and the Municipalities will be required in the operation of the systems put in place, or the establishment of contracts for the management of the networks.

With a programme in place the level of work should become more stable, workload stability will encourage investment in the training of manual labour by contractors. This would be aided by the establishment of longer term contracts with maintenance contractors.

10.2.2.7 Funding

The asset maintenance strategy, when implemented, will allow the ARI and the Municipalities to establish the most economical level of budget that is needed for the maintenance of the asset. Recognising that it

may not be possible to find sufficient funding it will be important to understand the effects of not providing the most economically efficient budget and so identify measures to mitigate the problems that would arise.

10.2.2.8 Asset Register and Management Information

The core of the asset maintenance strategy is the Asset Register itself. This and the Road Management Information System will allow the production of Management Information about the current state of the network, the needs of the network, its predicted future condition and other such information to be produced much more easily with reduced effort. This will allow the monitoring of the management of the network to be better monitored and any necessary changes identified.

10.2.2.9 Proposals for Monitoring and Evaluation

It is proposed that the effectiveness of the Road Maintenance Plan should be monitored by measuring the changing condition of the road network. The condition of the Road Networks should be measured by the value of the network. This should commence with the Republican Road Network and as skills and systems are rolled out it should be extended to the Municipal Roads.

10.2.3 Railways

10.2.3.1 Goals and Objectives

In the majority of railway organisations the maintenance and renewal of assets has been viewed in relative isolation as an engineering issue, however, railways rely on the performance of extensive physical assets to deliver their service and business requirements. Increasingly, railways are recognising the benefits of holistic asset management that provides a structured approach to ensuring and demonstrating that the assets deliver the required function and level of performance in terms of service output, in a sustainable manner, at an optimum whole life cost without compromising health, safety and environmental performance.

The objective of a railway asset maintenance strategy for Bulgaria must be to get the correct balance between maintenance and renewal to enhance infrastructure quality and service to customers at the most economic total life cost expenditure.

To achieve this, a three stage process is recommended in line with the strategic recommendations for the network as a whole:

- Rationalise the network and focus activity on core routes, recovering materials to use as strategic spares;
- Implement a heavy maintenance programme to return the rationalised network to designed performance parameters; and
- Implement a holistic approach to asset management that provides a structured framework supporting investment planning decisions based upon a clear understanding of asset condition, network performance requirements and funding constraints.

10.2.3.2 Rationalisation of the Network

The review of existing transport systems in Bulgaria has provided a strategic analysis of the demands upon the railway network and the opportunities available to it. This defined a strategic approach to rationalising the network and identified how it may be enhanced. The net effect of this will be to reduce the size of the network and the associated operating cost.

The network is more extensive and complex than the demand for passenger and freight services requires. Switch and crossing layouts at stations are generally complex which in turn creates complexity in the supporting systems, i.e. signalling and power supply. This creates a significant maintenance workload. In addition to the rationalisation of assets, consideration should be given to identifying the criticality of infrastructure assets to train service delivery and prioritising the maintenance on this basis. This would reduce the maintenance activity requirement (and costs) but support the business service aspirations.

10.2.3.3 Heavy Maintenance Programme

A detailed analysis of the railway's asset condition was not part of this study and as a consequence it is not possible to make specific remedial maintenance activity recommendations. However, based upon the data available from previous studies, example works and methods can be indicated by asset group to illustrate the benefits of a properly formulated maintenance strategy.

Track - a heavy maintenance programme targeting temporary speed restriction sites utilising serviceable materials from redundant routes where possible would have an immediate impact on network capability.

The majority of plant is over twenty years old and only 56% of it is in good working order. In the longer term an appropriate fleet of track maintenance equipment is essential to cost effective delivery of track maintenance.

Structures - due to the lack of maintenance to structures in the past and the likely limited forward budget, a systematic risk based approach to structures maintenance needs to be developed to ensure that the structures maintenance budget is targeted and prioritised to provide value for money.

This systematic approach should consider repair costs against those for structure replacement and should be based on whole life cost analysis.

Signalling and Communications - the approach to maintenance must utilise a planned cycle of intervention, using age as a proxy for condition and supported by regular inspection and centralised fault reporting systems.

Rationalisation of the network will enable the recovery of strategic spares to maintain obsolete systems on priority routes. Consideration should also be given to small scale life extension programmes where unreliable elements of the system are replaced in modern equivalent form.

Power and distribution - an inspection led maintenance regime is the key to successful asset management. Contact wire and catenary wire repair and maintenance, other than small scale, localised replacement, is not possible, hence total renewal by wire run/tension length is the only option. In addition, a campaign of replacement of small parts should be established based upon prioritisation of route and asset criticality. In the short term, corrosion of catenary supports should be tackled with a painting programme to extend asset life.

In the long term a considered renewal programme should be developed based upon an agreed technology policy and route strategy.

10.2.3.4 A modern asset management approach

The holistic approach recommended links asset maintenance, renewal and enhancement with service delivery and strategic business planning.

Key features of the approach include:

- Alignment of asset strategy and plans with strategic organisational objectives;
- Co-ordination of technical and operational activities;
- Measurement of outputs; and
- Continuous improvement.

10.2.3.5 Management, Administration and Regulation

To successfully implement an efficient asset management system the organisation should adopt an appropriate organisational structure that incorporates the following fundamental principles:

- Asset management is recognised as a function in the organisation in its own right at board level;
- Asset ownership, inspection and planning is segregated from maintenance delivery;
- An appropriate focus and importance is placed upon asset information;
- The mix of functional disciplines is properly recognised; and
- An independent audit function exists.

The asset management system needs to be underpinned by a complete set of business processes to ensure that decisions from strategy to implementation are internally consistent and effectively joined up. The processes are the key input to defining roles and responsibilities, to specifying the requirements for asset information and decision support tools and to managing the interfaces with other company systems and processes.

Where resource constraints limit the ability to deliver items of work a mitigation plan should be developed to eliminate any safety impact and minimise any impact on the service performance until the work can be rescheduled. This may include enhanced maintenance inspections and works.

Timely, accurate and accessible asset information is required to support all stages of decision making. A comprehensive set of information is required on, for example, asset type, location, installation date, utilisation, condition, failures and work records and plans. Asset information is currently decentralised and paper based. The implementation of a modern asset information system together with data management procedures and standards is essential.

10.2.3.6 Human Resources implications

The effectiveness of the asset management system depends ultimately on the competence of the people who make and implement the strategic and tactical decisions on the work to be undertaken on the infrastructure. It is therefore necessary to identify the competency and skills required to sustain the asset management system at all levels. This provides a benchmark for assessing gaps in competency and prioritising training and recruitment throughout the organisation.

The asset management organisation needs to be capable of delivering the strategic needs of NRIC. Skills and competences need to align with the methods of data collection and maintenance and be sized to be cost effective. A review of the organisation should be undertaken with recruitment, training and development needs identified in line with the requirements of the asset policies and available funding. The case for a formal asset register is strengthened by the knowledge that the workforce in NRIC is ageing and there is the risk of losing their knowledge of the infrastructure as they retire.

10.2.3.7 Funding

The strategic approach set out is achievable through the restructuring and utilisation of the existing organisation and can be tailored to meet agreed network output measures and timescales against available funding levels. However, procurement of plant and equipment will be required to support the strategy.

Detailed analysis of the asset condition and degradation modes together with a detailed assessment of the works required to deliver network output requirements will need to be undertaken to identify and justify ongoing investment to support the overall maintenance strategy within a pre-determined time scale. It is recommended that a five year funding plan is developed against agreed output measures that is affordable and supports the planning and delivery requirements of the strategy.

10.2.3.8 Proposals for Monitoring and Evaluation

For publicly owned infrastructure it is appropriate that regular audit, inspections and assessments are undertaken by an appropriate, independent agency. These include:

- Condition of infrastructure and asset stewardship;
- Reliability of network performance in relation to train service delivery;
- Financial efficiency and effectiveness of expenditure; and
- Safety of operation.

An appropriate monitoring regime should be established within the new regulatory structure.

10.2.4 Ports and Waterways

10.2.4.1 Goals and Objectives

Goals and objectives for Ports and Waterways include the development of an effective infrastructure maintenance strategy which will enable the required level of investment in maintenance essential to maximising terminal efficiency while achieving the most economical life cycle cost.

10.2.4.2 The plan for existing infrastructure

All existing major port infrastructure will be assessed during the masterplan reviews proposed. These reviews will confirm:

- Whether the infrastructure is still required following rationalisation of the number and type of terminals required to service the forecast trade;
- Whether the infrastructure needs to be redeveloped to accommodate dedicated special uses, e.g. grain, containers;
- Whether the infrastructure has the capacity in terms of vessel size, load carrying capacity, efficiency of operation etc to accommodate the proposed future uses; and
- Whether the infrastructure has an economical service life remaining.

Maintenance and repair strategies for each type of infrastructure should be developed. These will include:

- Condition audits and ongoing regular inspections;
- maintenance planning and procurement processes;
- upgrade/replacement planning and procurement processes; and
- urgent repairs procurement.

This will help determine the organisational and regulatory basis for maintenance programmes at all ports. It is particularly important in the case of terminals being offered to the private sector for operating

concession. The respective maintenance obligations of the infrastructure owner and a private operator need to be clearly and logically defined.

10.2.4.3 The plan for new/upgraded Master Plan generated infrastructure

The masterplan reviews will also identify the requirements for new and upgraded infrastructure following rationalisation of the existing asset.

The new and upgraded infrastructure will require a maintenance strategy similar to that for existing infrastructure. Exceptions will apply where the infrastructure is to be developed or upgraded by a private operator. In such cases the operator could be expected to be responsible for ongoing maintenance of most, if not all, of the terminal infrastructure.

If the port authority retains ownership of the basic infrastructure, the respective maintenance obligations of the infrastructure owner and a private operator need to be clearly and logically defined.

10.2.4.4 Investment in plant and equipment

Identified requirements for new plant and equipment will be considered as part of the recommendation within the Master Plan to identify ways of improving efficiency in terminal equipment procurement. This will provide the organisational and regulatory basis for faster equipment procurement. It will also provide the port operators with the ability to maintain a degree of uniformity in equipment types and manufacture.

Effective investment in plant and equipment will permit acceleration of terminal capacity improvements and reduction in inefficiencies in equipment inventories.

10.2.4.5 Management, Administration and Regulation

Changes to management, administration and regulation with respect to port and waterway infrastructure maintenance will be considered both as part of the port master plan reviews and through the specific Master Plan option to identify improvements to efficiency in terminal maintenance procedures.

10.2.4.6 Human Resources implications

Changes in responsibilities with respect to infrastructure maintenance and equipment procurement are likely to require adjustment in staffing levels and skill levels within each of the involved agencies, including Port Administration agencies, Port Infrastructure Companies and Port Operating Companies. Specific requirements will be defined during execution of Options W06 and W07.

10.2.4.7 Funding

Once the masterplan reviews and other options relating to port operational efficiency improvements are complete, funding requirements for implementation of the infrastructure maintenance and equipment procurement strategies are expected to be modest and mainly administrative in nature. External funding should not be required for this. This excludes ongoing investments required in infrastructure maintenance and repair and equipment procurement, which may be suitable for loan funding.

10.2.4.8 Asset register and management information

It is recommended that updated and upgraded asset registers are prepared for all ports to cover infrastructure, plant and equipment.

The management information system associated with this asset register should include:

- Condition audits and ongoing regular inspection reports;
- maintenance schedule and records;
- upgrade/replacement schedule and records; and
- maintenance cost forecasts and records.

10.2.4.9 Proposals for Monitoring and Evaluation

Output measurement and performance monitoring will need to be tailored according to the nature of the terminal infrastructure ownership and operation and the split of maintenance obligation between owner and operator.

For publicly owned and operated ports and terminals it is appropriate that regular inspections are undertaken by an appropriate agency. These inspections would include:

- condition of infrastructure;
- condition and operating efficiency of plant and equipment;
- occupational health and safety check of infrastructure, plant and equipment;
- infrastructure security; and
- overall terminal efficiency review (vessel service times, road/rail service efficiency).

For publicly owned and privately operated terminals it is also appropriate that regular inspections similar to the above are undertaken by an appropriate agency. These inspections would be mandated as part of the administration of the operating concession agreement. The scope of the inspections would be adjusted to reflect the asset ownership and the asset maintenance responsibility, but would still be a thorough health check of the terminal infrastructure and its operational efficiency.

10.2.5 Airports

10.2.5.1 Goals and Objectives

There is no evidence that lack of or poor maintenance is having a significant impact on the effective operation of Bulgaria's main operational civil airports at Sofia, Burgas, Varna and Plovdiv. The fifth operational airport at Gorna Oryahovitsa has seen little investment in the airport terminal building since it was constructed during the 1970s and the terminal is really configured only for domestic flights. The airside facilities at Gorna have seen major work in the last ten years to the runway and apron.

There are three other non-operational airports in Bulgaria (Ruse, Turgovishte and Stara Zagora) where the terminal building, apron and runway areas have not been maintained for many years and it would require significant investment to bring them up to acceptable operational standards.

These circumstances are very different to the other transport modes and highways and railways in particular. The goals and objectives and Master Plan recommendations for an asset maintenance strategy for Bulgaria's airports therefore reflect international best practice. The sections below provide an outline of the assets that typically require maintaining at airports and the reasons as to why maintenance of the asset is important.

10.2.5.2 Landside Maintenance

Landside assets will fall predominantly into four key areas:

- **Access Roads** - The maintenance of access roads and footways will be necessary to provide safety of pedestrians, cars and buses and to prolong the life of the asset. Although not a regulated asset, these features will need to be regularly inspected and maintained using simple highway maintenance techniques where defects arise.
- **Forecourts** - to facilitate arriving and departing traffic adjacent to and within terminal buildings. As there is a lot of pedestrian traffic within the forecourt areas, it is necessary to maintain footways and road crossings in good condition with no trip hazards that could cause injury to passengers.
- **Multi-storey Car Parks** - require careful monitoring and maintenance to principal and secondary structural elements. Multi-storey car parks should be considered as external structures often subjected to de-icing salts which can result in corrosion of main structural components. It is important therefore to have a regular regime of structural inspection by qualified engineers.
- **Surface Car Parks** - are either surfaced or unsurfaced, but both require only minimal maintenance. As there is a lot of pedestrian traffic within surface car parks, it is necessary to maintain footways and road crossings in good condition with no trip hazards that could cause injury to passengers.

10.2.5.3 Terminal Maintenance

Terminals are complex buildings housing a number of distinct areas and processes. The buildings are typically of large span construction requiring significant electrical, heating and air conditioning plant. Terminals will also house a significant array of IT and security equipment, baggage handling facilities, flight information displays and data handling hardware. Broadly, the management of the terminal asset can be split into the following categories:

- Building structure (principal structure, cladding/glazing, etc.);
- Building services (heating, cooling, lighting, sewerage, electricity generation and cabling, water supply, etc.); and
- Specialist items (Baggage conveyor systems, flight information display systems, security scanners, CCTV, fire protection and smoke detection, etc).

The final items, in particular, require specialist asset management programmes, implementation and funding strategies.

10.2.5.4 Airside Maintenance

The primary requirement in airside asset maintenance is to ensure the continued safe operations of aircraft during take-off, landing, taxiing and storage. The key aspects can be summarised into nine key areas:

- **Minimum runway friction levels** - Runways must have a minimum friction level in order that accelerating and decelerating aircraft do not skid or aquaplane. The specific runway friction requirements are outlined in ICAO Annex 14 Chapter 10. The policy must be to maintain, to undertake regular assessments of runway surface friction characteristics and to ensure that friction is maintained at an acceptable level, but in any case does not fall below the State-set Minimum Friction Level (MFL).
- **Aeronautical ground lighting (calibration) and navigation aids** - provides flight crew with location, orientation and alignment information in adverse visibility conditions and at night. Frequent inspection is required to ensure the stability of ground lighting fittings within the pavement, ensuring a minimum number of lights out of action and maintaining a uniform and appropriate brilliancy level. Navigation and landing aids must be monitored and inspected for accuracy and systems must be regularly calibrated using flight calibration systems.
- **Airfield pavement surface condition** - Pavement surfaces must be inspected and kept free from foreign object debris such as parts of aircraft, wind blown rubbish or deteriorating pavement surface material.
- **Airfield pavement structural capability** - Pavement forming part of the movement area needs to be of sufficient strength to allow aircraft to operate without risk of damage either to the pavement or to the aircraft. To control this it is necessary to classify both pavement and aircraft under a system whereby the load-bearing capacity of the pavement and the loads imposed by the aircraft can be compared. Any pavements which have been subjected to overload conditions should be closely monitored by suitably qualified staff for a period of several weeks or until it is clear that no rapid deterioration of the pavement has been triggered. All pavements have a finite fatigue life and as such their condition must be monitored in order to anticipate and resolve the onset of structural failure. The monitoring of airfield pavements requires trained personnel and specific automated data collection survey machines.
- **Airfield drainage systems** - Aircraft manoeuvring surfaces must be kept free from standing water flooding during storms and local watercourses must be kept free from the ingress of pollutants such as de-icing fluids. It is important therefore that there is a regular regime of drainage inspection and maintenance, including cleaning out of pollutant interceptors, pipes and chambers.
- **Airfield services provision (rescue, fire fighting and snow clearing assets)** - It is imperative that all plant and equipment, including facilities to house such equipment, are maintained in good order to ensure their availability and functionality during emergencies.
- **Airfield utilities (electrical supply resilience)** - Given the safety critical nature of airport operations and the reliance upon such operations on electrical equipment including landing aids and aeronautical ground lighting, it is important to maintain resilience within the airport's electricity generation and distribution. Therefore there is an ongoing requirement to maintain electrical generators, substations and cabling and renew these facilities on a periodic basis.
- **Maintenance of the wider airfield environment** - The safety of aircraft may be significantly compromised by the presence of birds, which when ingested into aircraft engines can result in serious consequences to aircraft operability. Therefore, the unsurfaced areas of airfields must be maintained with grasses of such height and type that will not become an attractive habitat for birds. This requires an intensive grass cutting regime.
- **Maintenance of off-airfield obstacles** - The effective utilisation of an aerodrome may be considerably influenced by natural features and man-made constructions inside and outside its boundary. These may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. The method of assessing the significance of any existing or proposed object within the aerodrome boundary or in the vicinity of the aerodrome is to establish defined obstacle limitation surfaces particular to a runway and its intended use. When a surface is infringed certain safety protocols may need to be instigated, and various natural obstacles such as trees will require maintenance in order to maintain their height.

10.2.5.5 Proposals for Monitoring and Evaluation

Given the safety critical nature of airport infrastructure, it is always prudent to set out for each airport an Aerodrome Safety Management System (SMS) within which asset management requirements can be structured.

An effective Safety Management System forms the primary safety oversight covering the way an aerodrome manages safety. An aerodrome SMS should demonstrate an identifiable and easily audited systematic control of the management of safety at an aerodrome. It should be able to display to the aerodrome organisation and prove to the regulating authorities that all activities including asset

management result in continuous compliance with the safety requirements and, by applying lessons learned, aims to make improvements to the overall level of safety.

10.3 Implementation and Funding Strategy

10.3.1 Introduction

This section sets out a strategy for the funding and implementation for projects within the GTMP together with an indicative programme. Specifically it addresses:

- the current situation in Bulgaria on funding and delivery for the programme of schemes that have been identified in current programmes;
- a review of the various funding options that are available to finance each scheme in the GTMP and the implication that these may have on implementation;
- recommendations on how each option within the GTMP could be funded; and
- an overall programme showing the design, development, construction/delivery stages and beginning of operations for each option within the GTMP.

10.3.2 Current Status of Scheme Funding and Delivery

10.3.2.1 Background

There are seven operational programmes set up for Bulgaria, using investment from the European Union Structural Funds and Cohesion Fund. Finance for transport schemes can be sourced from these through the Operational Programme on Transport (OPT). This programme covers the period from 2007 to 2013 and is principally concerned with the investment in road, rail and waterway infrastructure schemes. The aim of this programme is that projects included within it will assist in providing a more integrated transport network within the EU. Any scheme applying for investment through this funding vehicle must fund a minimum of 15% of the project costs from other sources.

All schemes within the OPT have all been considered as part of the development of the GTMP and fall in to one of three categories:

- Schemes that are outside the remit of the GTMP, the prime example being the extension of the Sofia Metro which as an urban transport scheme falls outside the terms of reference of the project. These schemes do not form part of the GTMP;
- Schemes that are currently in the process of delivery, an example being the electrification of the railway between Svilengrad and the Turkish border. These schemes are assumed to form part of the do-minimum or base case for the GTMP; and
- Other schemes, all of which have been recommended for implementation as part of the GTMP.

10.3.2.2 Highway Schemes

- **H08 – "Trakia" Motorway: Lots 2, 3 and 4 Stara Zagora to Karnobat (115 km)**

The total construction cost of these three sections is estimated at €350 million with €280 million provided from the EU Cohesion Fund and € 70million from national government budgets. The procurement process for Lot 2 has recently commenced and is due to be completed in the first half of 2010. The current completion date for construction of all sections is 2013.

- **Parts of H14 – "Struma" Motorway Dolna Dikanya to Kulata (133km)**

Only Lots 1, 2 and 4 are programmed for the current (2007-2013) OPT programming period. The total estimated cost of the 3 lots is €250 million. It is proposed that funding will be split with €200 million to be funded by the EU Cohesion Fund and the remaining €50 million coming from the national budget. The tender process for Lot 1 is planned to begin in autumn 2010 with completion planned by 2013. Tendering for Lots 2 and 4 is scheduled to take place in 2011 with construction completion planned for 2013. The longest and most complex section, Lot 3, is not intended to go ahead until after 2014.

- **Part of H23b Ruse to Makaza (section from Kardjali – Podkova)**

Rehabilitation of 12 kilometres of existing highway and the construction of 16.5 kilometres, split into two sections from Kardjali to Djebel and Djebel to Podkova. The total scheme cost is currently estimated at €32 million with €25.6 million to come from EU Cohesion Fund and the remaining €6.4 million to be provided from National funds. At the current time, whilst still in the Operational Programme, the scheme is not viewed as one of the highest priorities in comparison with other proposed projects.

- **H10 – "Hemus" Motorway Sofia Ring Road to Yana**

Provision of an 8.5km section of new road linking Sofia ring road and the existing Hemus motorway at Yana. The cost of the scheme has been estimated at €32 million with €25.6 million to come from the Cohesion Fund and the remaining €6.4 million to be provided from national funds. The preparatory works

have been largely completed and the tender process is due to commence in Spring 2010, ahead of a contract appointment in the Summer of the same year. Construction is scheduled for completion by Spring 2012.

- **H12 – "Maritsa" Motorway between Chirpan and Harmanli**

The tendering process for the new section is planned to commence in 2010 with construction completion currently scheduled for Spring 2013. Funding for the scheme is proposed to be through a combination of the Cohesion Fund (€166 million) and national financing (€41 million).

- **Part of H19 – Modernisation of road section (E 79) between Vratsa and Botevgrad**

The total scheme cost is currently estimated at €85 million with €68 million to come from the Cohesion Fund and the remaining €17 million to be provided from the State budget. The current scheduled completion date for this scheme is 2013.

- **Part of H19 – Road section E 79 between Vidin and Montana**

The total project cost is currently estimated at €32 million with €25.6 million to be provided with the Cohesion Fund and the remaining €6.4 million to be funded from the State budget.

10.3.2.3 Rail Schemes

- **R12 – Modernisation of the Vidin – Sofia line**

The scheme been estimated at €320 million, with €256 million being provided by the Cohesion Fund and the remaining €64 million coming from national co-financing. The procurement process for appointing contractors should be completed in 2012 with construction work on the scheme commencing in 2013.

- **Part of R14 – Modernisation of the Sofia – Pernik – Radomir route**

The modernisation of this route to bring speeds up to 160kph is planned to be completed by 2013. The total scheme cost is currently estimated at €100 million, to be funded 80% by the EU and 20% from national budgets.

- **Part of R13 – Modernisation of Sofia – Plovdiv line**

The modernisation of this route is planned to be completed by 2014. The total scheme cost is currently estimated at €324 million, with €259 million being provided by the EU Cohesion Fund and the remaining €65 million from national budgets.

10.3.2.4 Ports and Waterways Schemes

- **W10 – Vessel Traffic Management System – Phase 3**

The scheme for real-time monitoring of shipping movements on the River Danube has been estimated at €3.8 million. Of this sum, it is envisaged that €3.3 million will be provided from EU Structural Funds and €0.5 million from national co-financing. The OPT lists this programme for completion by 2010.

- **W11 – Navigation Improvements on the Danube River**

The scheme of navigation improvements is currently estimated at €138 million with €117.3 million to come from the Cohesion Fund and €20.7 million co-financed from the State budget. The OPT lists the scheme as being completed during the period of 2010 to 2015.

- **W12 – River Information Services System in the Bulgarian Part of the Danube River**

The cost of implementation has been estimated at €15 million, with €12.75 million of this funding being provided by the European Regional Development Fund. The remaining €2.25 million would be funded from national co-financing. The scheme is listed in the OPT for completion between 2008 and 2013.

- **W13 – Winter Shelter at Ruse Port**

The third of three phases would see winter shelter accommodation for ships extended to 39 berths. This phase, originally scheduled for completion by 2007, is to be funded through government investment. The implementation of the project is delayed because of force majeure conditions and is expected to be completed in 2011.

10.3.3 Review of Funding Options

10.3.3.1 Funding Sources

There are a number of potential funding sources for each type of intervention. The funding sources can be aggregated into six groups:

- National Government;
- EU;
- World Bank;
- Financial Institutions including the European Investment Bank;

- Concessions and Government subsidies; and
- Public Private Partnerships (PPP) and other Private Sector Investments.

In some cases funding will include a combination of these.

10.3.3.2 Funding from the State Budget

As stated in section 2.4.1 the national state budget for spending on transport, excluding the budget for the ARI which is held separately, in 2009 was BGN 81.5 million. This was a 5% increase over the 2008 total of BGN 77.7 million. The transport budget for 2010 adopted in December 2009 is BGN 80.2 million, a reduction of 1.5%.

Within the context of a global economic downturn and with Bulgaria currently going through its first recession in 12 years, funding from the National Government is currently being scrutinised and it is likely that the availability of funding for transport projects may be constrained in the short term and this will impact on the implementation for schemes co-funded with the EU. It will also place some pressure on alternative forms of funding.

10.3.3.3 EU Funding

There are principally two types of European funding available to Bulgaria for transport purposes – the European Regional Development Fund (ERDF) and the Cohesion Fund (CF). The European Social Fund (ESF) completes the funds available to meet the EU's Convergence Objective but is only occasionally used for transport projects.

The ERDF supports programmes addressing regional development, economic change, enhanced competitiveness and territorial co-operation throughout the EU. Funding priorities include research, innovation, environmental protection and risk prevention, while infrastructure investment retains an important role, especially in the least-developed regions. The ERDF covers region who's GDP per capita is below 75% of the EU average and aims at accelerating their economic development. Currently the GDP per Capita for Bulgaria is about 40% of the EU27 average of 24,300 Euros (2009 estimate)

The Cohesion Fund (CF) contributes to interventions in the field of the environment and trans-European transport networks. It applies to Member States with a Gross National Income (GNI) of less than 90% of the community average, which means it covers the new Member States as well as Greece and Portugal.

The 2008 annual report on OPT progress identified delays in the preparation of EU funded projects which has been caused by setbacks in the feasibility studies, primarily as a result of the use of outdated environmental impact assessments (EIA) and funding shortfalls for land acquisitions. Remedial action through consultation with the EC and active cooperation with JASPERS has therefore been sought.

Table 10.1 identifies, in Euros, the level of assistance by priority areas informed by the financial plan of the National Strategic Reference Framework (NSRF) of the Republic of Bulgaria 2007 – 2013. The funding ratios identified below have provided the basis of the financial plan of the OPT as reported in August 2009.

Table 10.1 - Breakdown of EU assistance by Priority areas (in Euro's)

Priority axis – EU Fund	Community funding	National public funding	Total funding	Rate of EU Funds Contribution
Priority Axis I - Railway infrastructure	€464,000,000	€116,000,000	€580,000,000	80 %
Priority Axis II - Road Infrastructure	€791,669,892	€197,917,473	€989,587,365	80 %
Priority Axis III - Inter-modality for passengers and freight	€179,429 731	€31,664,070	€211,093,801	85 %
Priority Axis IV –Maritime and Inland-Waterway Navigation	€133,322,500	€23,527,500	€156,850,000	85 %
Priority Axis V - Technical Assistance	€56,057,500	€9,892,500	€65,950,000	85 %
TOTAL	€1,624,479,623	€379,001,543	€2,003,481,166	81 %

EU funding for road infrastructure through the OPT is the highest of all the priority axes but in total is capped at a maximum of 49% of the total available funds.

The level of assistance allocated to Maritime and Inland Waterway Navigation at €156,850,000 is just less than 8% of the total. In future operational programmes there are strong arguments that this proportion

should be significantly increased to reflect the importance of water transport to supporting the growth of international trade and its contribution to Bulgaria's future prosperity.

10.3.3.4 World Bank

The World Bank has a role in assisting developing countries around the globe through the provision of low-interest loans, interest free credits and grants. The financial and technical assistance provided by the institution is used to help increase the rate of countries development. The Bank's investment covers areas including public administration, infrastructure and financial and private sector development with strategic investment in transport covered within its remit.

The World Bank provides financial and technical assistance to developing countries. It comprises two development institutions: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The IBRD aims to reduce poverty in middle-income and creditworthy poorer countries including Bulgaria, while IDA focuses on the world's poorest countries.

Bulgaria has benefitted from World Bank investment through the Road Infrastructure Rehabilitation Project. This project has provided funding through a $122.5 million loan to help the country reduce road transport costs by improving the condition and quality of its road network during the first years of EU accession. A Railway Infrastructure Rehabilitation Project is also at the concept stage and has a value of $266.25milliion.

10.3.3.5 Financial Institutions

Financial institutions and private sector banks and funds, are a source of capital and operating funding. Although much is made of capital funding requirements there may also be a significant need for working capital in the early years of an infrastructure scheme to cover set up and operational costs. In addition, the institutional, regulatory and management schemes, which have no or little capital expenditure, may require a stream of funding to cover any gaps in revenue funding.

The principal financing institution of the European Union is the **European Investment Bank** (EIB) which provides long term lending to the public and private sectors. The organisation is not for profit and owned by the EU member states with an identified task of contributing towards the *"Integration, balanced development and economic and social cohesion of the EU Member States" (EIB 2009).* Bulgaria has benefited from 15 years of funding to support its convergence with the European Union with funding across the key economic sectors including infrastructure. Since 1990, €1.24 billion has been made available to Bulgaria for financing investment projects in connection with meeting the EU accession criteria partly as co-financing with EU Cohesion and Structural Fund Grants. In the infrastructure sector urban transport and opportunities for improving national and regional linkages through investment in railways and highways have been identified as areas where support should be provided. Up to 50% of project costs can be provided by the EIB as loans provided the project is viable and sound, costs more than €25 million and is in line with EIB lending objectives.

Projects in Bulgaria for which finance contracts have been signed have included projects in Sofia to improve the city's Metro and municipal infrastructure, co financing for operational and rural development programmes (including transport improvements), repairing and upgrading 1,535 km of priority transit roads and €70 million towards the construction of the Vidin - Calafat road and rail bridge between Bulgaria and Romania.

The **European Bank for Reconstruction and Development** (EBRD) is an international financial institution that assists countries from Central Europe to Central Asia through initiatives to promote entrepreneurship and assist countries with a move towards the open market and democracy. Predominantly investment is targeted at private sector clients whose requirements are currently not met by the market. The EBRD invests in transport Infrastructure, projects and systems across the following sectors:

- Aviation;
- Ports;
- Railways;
- Road transport;
- Shipping; and
- Logistics.

The EBRD has been a significant investor in Bulgaria with over one hundred projects with total project costs of €6 billion. The EBRD's strategy for Bulgaria published in May 2008 states that it will invest in enhancing *"competitiveness and to support investments for local production and job creation"*.

Many countries especially amongst those with high GDP per Capita have development funding and investment organisations that operate in a similar way to the EIB and EBRD. For example Japan's Bank for International Cooperation (JBIC), wholly owned by the Japanese Government, has invested $600m in improving facilities in Varna and Burgas Ports and has given loans to support development of Sofia Metro.

The private sector banks and other financial institutions could be a source of capital and operating funding especially where there is a revenue source (or capture of cost savings) that can be allocated to the principal and interest payments. The interest rate on any loan will be strongly influenced by a combination of the risk rating of Bulgaria as a country and the risk associated with the type of project being funded.

10.3.3.6 Public-Private Partnerships

The term Public Private Partnership (PPP) is used to describe a project to provide public sector services, where they are delivered through co-operation between the government and a private sector business or consortium of companies. Under this form of partnership the private sector is normally responsible for the design, construction, financing, operation and maintenance.

A contract is agreed between the public sector and the private sector organisation, in which the private party is responsible for providing the public service and assuming responsibility for the majority of financial, technical and operational risk within the project. Under some PPP contracts, the cost of using the service is funded exclusively by the users, with no financial risk to the taxpayer.

Government contributions to a PPP may also be in kind (notably the transfer of existing assets). In projects that are aimed at creating public goods such as in the infrastructure sector, the government may provide a capital subsidy in the form of a one-time grant, so as to make it more attractive to the private investors. In some other cases, the government may support the project by providing revenue subsidies, including tax breaks or by providing guaranteed annual revenues for a fixed period.

A concession is a particular form of PPP where a business or service is operated by an individual or company under the terms of a contract, which grants the concessionaire the benefit of exclusivity within a defined geographical area, in exchange for a financial payment. This is normally in the form of a fixed sum or percentage of the revenue that the item being "concessioned" will generate.

The benefit of PPP as a funding vehicle is that it can facilitate investment and development of an area that may struggle to be justified, were it to be solely reliant on funding through the public sector. The projects also tend to be delivered more efficiently as the private investor has a financial incentive to focus on cost, risk management and quality.

The GTMP is proposing a significant number of infrastructure projects and it is very likely that the EU and national governments will not be able to fund all the projects. PPP therefore offers an alternative source of funding that may allow a greater number of projects to be delivered within a shorter timeframe than would otherwise have been possible. PPP are especially appropriate in circumstances where there is a clearly defined project, which can be isolated from other schemes, and a readily available revenue stream. This could come from direct tolls/fares or from availability payments from the public sector.

A private finance initiative (PFI) is a form of PPP that involves some form of public sector investment, whereby the public sector purchases capital items from the private sector but still maintains a substantial role in the project. This type of project also differs from a PPP in that the public sector is also responsible for arranging financing for the project. Once constructed, the responsibility and risk for operating and maintaining the asset is transferred to the private sector.

10.3.4 *Recommendations on Funding*

Based on the type of scheme involved and the likely availability of funds from different sources the following tables outline the potential sources to fund the capital and operating expenditure of the schemes included within the Master Plan. Those schemes shaded are already committed within the OPT (highlighted in red are those within the 2007 – 2013 programme and those in yellow have been proposed for inclusion within the 2014 – 2020 programme) so capital funding has already been proposed to be generated mainly through a combination of EU and national budget funding. Should any of these schemes be removed from the OPT then other funding sources may be available to ensure that they are still progressed.

To increase the possibility of receiving additional EU funding, it will be important to prioritise those schemes than can be delivered quickly, to demonstrate that progress is being made in implementing the Master Plan. Schemes that have the potential to either be profitable or at least directly generate revenue that either will at least contribute to operating costs or be used to fund capital investment in other projects should also be prioritised.

Table 10.2 - Proposed Funding Sources to Cover Capital Expenditure

Scheme Number	Scheme Description	Funding Sources					
		EU CF/ ERDF	State Budget	Conce-ssion	PPP /PFI	World Bank	Other Loan
Corridor 1 – Serbia (Kalotina) – Sofia – Plovdiv – Chirpan – Turkey (Svilengrad) (TEN-T IV, VIII, IX & X)							
H12	Maritsa – Chirpan to Harmanli	✔	✔				
R13	Sofia to Plovdiv to Burgas	✔	✔				
IM01	Plovdiv Inter-Modal Terminal	✔	✔	✔	✔	✔	✔
Corridor 2 – Macedonia (Gyueshevo) – Sofia – Plovdiv – Burgas – Varna (TEN-T IV & VIII)							
H08	Trakia – Stara Zagora to Karnobat	✔	✔				
R13	Karnobat to Varna	✔	✔		✔	✔	✔
H13	Black Sea – Burgas to Priseltsi	✔	✔	✔	✔	✔	✔
H17	Rila – Dupnitsa to Hemus		✔	✔	✔	✔	✔
Corridor 3 – Romania (Vidin) – Sofia – Greece (Kulata) (TEN-T IV)							
H19	I-1/E79 – Botevgrad to Dimovo	✔	✔				
R12	Sofia – Vidin	✔	✔				
H14	Struma – Dolna Dikanya to Kulata	✔	✔				
R14	Sofia to Radomir	✔	✔				
R14	Radomir to Kulata	✔	✔	✔	✔	✔	✔
Corridor 4 – Romania (Ruse) – Veliko Tarnovo – Haskovo – Greece (Makaza) (TEN-T IX)							
H23b	I-5/E85 – Ruse to Makaza	✔	✔				
R23	Ruse - Gorna - Stara Zagora		✔		✔	✔	✔
IM02	Ruse Inter-Modal Terminal	✔	✔	✔			
Corridor 5 – Sofia – Veliko Tarnovo – Shumen – Varna (TEN-T IV)							
H10	Hemus - Sofia Ring Road to Yana	✔	✔				
R21	Sofia - Gorna - Varna		✔		✔	✔	✔
H11	Hemus – Yablanitsa to Shumen		✔	✔	✔	✔	✔
Corridor 6 – River Danube (Confluence of Timok River to Silistra) (TEN-T VII)							
W11	Navigation improvements	✔	✔				
W13	Danube River winter shelter		✔				
Sofia							
H15	Sofia Ring Road North Arc		✔	✔	✔	✔	✔
A09	Sofia Airport		✔	✔	✔	✔	✔
H16	Sofia Ring Road South Arc		✔	✔	✔	✔	✔
Network Strategies							
W08	Receival of liquid and hard wastes	✔	✔	✔			
R11	Locomotives and Rolling Stock		✔				✔
W10	VTIMS	✔	✔				
W12	Information System for the Danube	✔	✔				

Table 10.2 above deals with the potential for funding of capital expenditure while **Table 10.3** below considers funding for operating expenses either during set up and ramp up of use (or benefit) or during the operation of the scheme or programme.

For those rail schemes that involve the rehabilitation or upgrade to existing infrastructure on a route we have assumed that PPP financing is a realistic possibility given that a revenue stream (from existing passengers) is already being generated which would increase should the scheme in question go ahead. For most rail cases, a level of subsidy will be necessary given existing patronage volumes.

For the Sofia Ring Road schemes EU funding should not be necessary as the very high Benefit to Cost ratios and economic growth of Sofia are likely to make them an attractive investment to the private sector (for a PPP or Concession type of scheme). This is most likely to be linked to availability payments than direct user payments. This would allow the limited EU and national funds to be focused on other routes that offer more strategic importance albeit with a poorer business case.

The environmental benefits for scheme W08 (the receival of liquid and hard wastes) should make it eligible to other EU funding sources related to schemes that deliver positive environmental impacts.

Table 10.3 - Proposed Funding Sources to Cover Operational Expenditure

Scheme Number	Scheme Description	Funding Sources					
		EU CF/ ERDF	State Budget	Conce-ssion	PPP /PFI	World Bank	Other Loan
Corridor 1 – Serbia (Kalotina) – Sofia – Plovdiv – Turkey (Svilengrad) (TEN-T IV, VIII, IX & X)							
H12	Maritsa – Chirpan to Harmanli		✔	✔			
R13	Sofia to Plovdiv to Burgas		✔		✔		
IM01	Plovdiv Inter-Modal Terminal	✔	✔	✔	✔		✔
Corridor 2 – Macedonia (Gyueshevo) – Sofia – Plovdiv – Burgas - Varna (TEN-T IV & VIII)							
H08	Trakia – Stara Zagora to Karnobat		✔	✔			
R13	Karnobat to Varna		✔				
H13	Black Sea – Burgas to Priseltsi		✔	✔			
H17	Rila – Dupnitsa to Hemus		✔	✔	✔		
Corridor 3 – Romania (Vidin) – Sofia – Greece (Kulata) (TEN-T IV)							
H19	I-1/E79 – Botevgrad to Dimovo		✔	✔			
R12	Sofia – Vidin		✔				
H14	Struma – Dolna Dikanya to Kulata		✔	✔			
R14	Sofia to Kulata		✔	✔	✔		
Corridor 4 – Romania (Ruse) – Veliko Tarnovo – Haskovo – Greece (Makaza) (TEN-T IX)							
H23b	I-5/E85 – Ruse to Makaza		✔	✔			
R23	Ruse - Gorna - Stara Zagora		✔		✔		
IM02	Ruse Inter-Modal Terminal	✔	✔	✔			
Corridor 5 – Sofia – Veliko Tarnovo – Shumen – Varna (TEN-T IV)							
H10	Hemus - Sofia Ring Road to Yana		✔	✔			
R21	Sofia - Gorna - Varna		✔		✔		
H11	Hemus – Yablanitsa to Shumen		✔	✔	✔		
Corridor 6 – River Danube (Confluence of Timok River to Silistra) (TEN-T VII)							
W11	Navigation improvements		✔				
W13	Danube River winter shelter		✔				
Sofia							
H15	Sofia Ring Road North Arc		✔	✔	✔		
A09	Sofia Airport		✔	✔	✔		
H16	Sofia Ring Road South Arc		✔	✔	✔		
Network Strategies							
H05	Road safety campaign		✔				
W05	Port efficiency improvements		✔	✔			
IM05	Inter-Modal Rail Rolling Stock		✔				✔
W06	Terminal maintenance procedures		✔	✔			✔
W08	Receival of liquid and hard wastes		✔	✔			
R11	Locomotives and Rolling Stock		✔				✔
W10	VTIMS	✔	✔	✔			
W12	Information System for the Danube	✔	✔				

There are a number of reviews, studies and improvements in management and administration that are short term and do not require capital funding or medium to long term operating support. These schemes include:

Highways

- H01 Roads Infrastructure Administration and Network Hierarchy;
- H03 Preparation of Network Maintenance Plan and Asset Monitoring System;
- H06 Introduction of Driver Information Systems; and
- H07 Review of Academic and Professional Training and the Role of Research Institutes.

Railways

- R01 Railway Administration;
- R02 Funding and Charging;
- R03 Network, Station and Freight Facilities Rationalisation;
- R05 Asset and Information management /Network Maintenance Plan;
- R07 Speed Enhancements;
- R08 Passenger Facilities; and
- R09 Passenger Information.

Water and Ports

- W00 Port Operational Assessments and certification;
- W03 Reservation of Land and Water Areas for Port Use (All Ports);
- W04 Management of Concession Procedures (all ports);
- W14 Port of Varna Review of Master Plans and Development Strategy;
- W26 Port of Burgas Review of Master Plans and Development Strategy;
- W41 Port of Lom Review of Master Plans and Development Strategy; and
- W47 Port of Ruse Review of Master Plans and Development Strategy.

Air

- A01 Airport Charges;
- A02 Air Market Study;
- A03 Security Operations; and
- A08 Plovdiv, Burgas and Varna Airports.

Intermodal

- IM03 Public Transport Interchange;
- IM04 Port/Rail Interchange.

The above comprise a number of different types of relatively low cost schemes that may or may not progress to major investment proposals at a later stage. These interventions can be categorised as follows:

- Market and Charging studies (R02, A02, A08);
- Strategy development (H06, W03);
- Financial and economic business cases (R07, R08, R09, A01);
- Consideration of options and development of plans (H03, R03, R05, IM03, IM04);
- Reviews of existing plans and strategies (H07, W14, W26, W41, W47); and
- Improvement of management and administrative processes (H01, R01, W00, W04, A03).

Some of these schemes may be funded internally by the Government department with responsibility for the area of concern or in some cases through a combination of EU and national budgets for example under Priority Axis 5. In the case of site specific studies and reviews, such as those at the ports, the responsible managing and controlling authority may fund the scheme.

The consideration of funding mechanisms for each scheme has not resulted in a single recommendation but a range of feasible options. The selections in Table 10.2 and 10.3 are those funding sources that are the most likely to be available for each scheme. The ultimate funding route will include either a single source or a combination of sources from these tables but the final outcome will depend on the detailed business cases and discussions with the EU, the Ministry of Transport, the Ministry of Finance and the potential private sector funders and deliverers.

10.3.5 *Implementation Plan*

An implementation plan has been developed taking into account all of the projects which have been identified for implementation by the Master Plan. The schemes can be broken down into the following four categories:

- Projects which are in the process of being constructed or in the case of institutional, regulatory and management schemes in the final stages of development;
- Projects which are currently under development;
- Projects which are currently being considered for funding; and
- Projects that have not yet been submitted in the form of a business case to any funding organisation.

It is essential that realistic timescales are determined for all schemes within each category and for the Master Plan as a whole. In the development of the implementation plan consideration has been given to a range of inputs which impact upon option delivery, including consultation with relevant stakeholders, to ensure that a robust pipeline of projects is established.

In providing implementation plans for each project input has been sought from the project's experts who have been responsible for reviewing proposals for each mode.

The Implementation Plan incorporates an appreciation of funding availability and potential delays which would require a flexible approach to delivery to ensure that a steady flow of input from funding sources provides a managed delivery process.

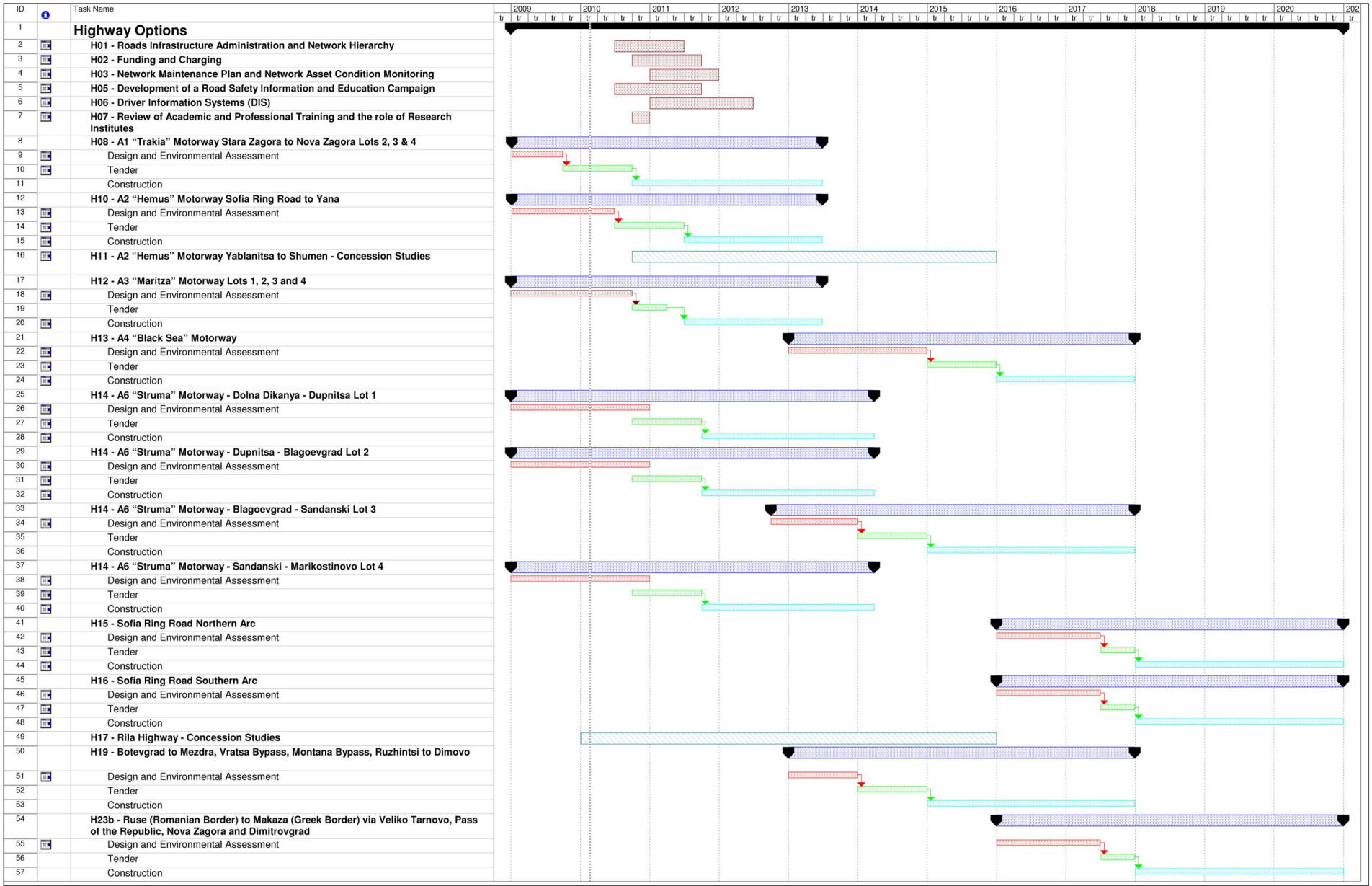
The Gantt charts below summarise the consultant's recommendations for a programme of implementation.

This programme cannot be taken as fixed. There are many unknowns and uncertainties that will influence the final delivery programme. It is natural that some schemes that currently rank highly will be delayed or even replaced, similarly some schemes that are currently low on the priority list may be advanced and others that are not included in the Plan introduced.

The programme does not identify every individual activity relating to progress and delivery of a project. For clarity and simplicity different tasks are grouped together. For example the design element includes preliminary and detailed design and usually concludes with land acquisition following the achievement of all necessary approvals. Where an Environmental Assessment is undertaken then approvals and land acquisition will not usually occur until it is accepted at a national level. Where EU funding is required then EU acceptance of the Environmental Assessment will also be required.

The implementation of each scheme, which requires a procedure for development of an Environmental Impact Assessment or an Environmental Assessment, has to fully comply with the measures for prevention, mitigation or elimination of eventual adverse impacts on environment from the implementation of the GTMP, as set out in Opinion No. I-1/2010 of the MoE&W, which was quoted and discussed in Section 9.8.7.

Finally, it is assumed that for infrastructure projects the beginning of operations or use of the scheme is on completion of the construction period.


ID
Task Name
1 Highway Options
2 H01 - Roads Infrastructure Administration and Network Hierarchy
3 H02 - Funding and Charging
4 H03 - Network Maintenance Plan and Network Asset Condition Monitoring
5 H05 - Development of a Road Safety Information and Education Campaign
6 H06 - Driver Information Systems (DIS)
7 H07 - Review of Academic and Professional Training and the role of Research Institutes
8 H08 - A1 "Trakia" Motorway Stara Zagora to Nova Zagora Lots 2, 3 & 4
9 Design and Environmental Assessment
10 Tender
11 Construction
12 H10 - A2 "Hemus" Motorway Sofia Ring Road to Yana
13 Design and Environmental Assessment
14 Tender
15 Construction
16 H11 - A2 "Hemus" Motorway Yablanitsa to Shumen - Concession Studies
17 H12 - A3 "Maritza" Motorway Lots 1, 2, 3 and 4
18 Design and Environmental Assessment
19 Tender
20 Construction
21 H13 - A4 "Black Sea" Motorway
22 Design and Environmental Assessment
23 Tender
24 Construction
25 H14 - A6 "Struma" Motorway - Dolna Dikanya - Dupnitsa Lot 1
26 Design and Environmental Assessment
27 Tender
28 Construction
29 H14 - A6 "Struma" Motorway - Dupnitsa - Blagoevgrad Lot 2
30 Design and Environmental Assessment
31 Tender
32 Construction
33 H14 - A6 "Struma" Motorway - Blagoevgrad - Sandanski Lot 3
34 Design and Environmental Assessment
35 Tender
36 Construction
37 H14 - A6 "Struma" Motorway - Sandanski - Marikostinovo Lot 4
38 Design and Environmental Assessment
39 Tender
40 Construction
41 H15 - Sofia Ring Road Northern Arc
42 Design and Environmental Assessment
43 Tender
44 Construction
45 H16 - Sofia Ring Road Southern Arc
46 Design and Environmental Assessment
47 Tender
48 Construction
49 H17 - Rila Highway - Concession Studies
50 H19 - Botevgrad to Mezdra, Vratsa Bypass, Montana Bypass, Ruzhintsi to Dimovo
51 Design and Environmental Assessment
52 Tender
53 Construction
54 H23b - Ruse (Romanian Border) to Makaza (Greek Border) via Veliko Tarnovo, Pass of the Republic, Nova Zagora and Dimitrovgrad
55 Design and Environmental Assessment
56 Tender
57 Construction
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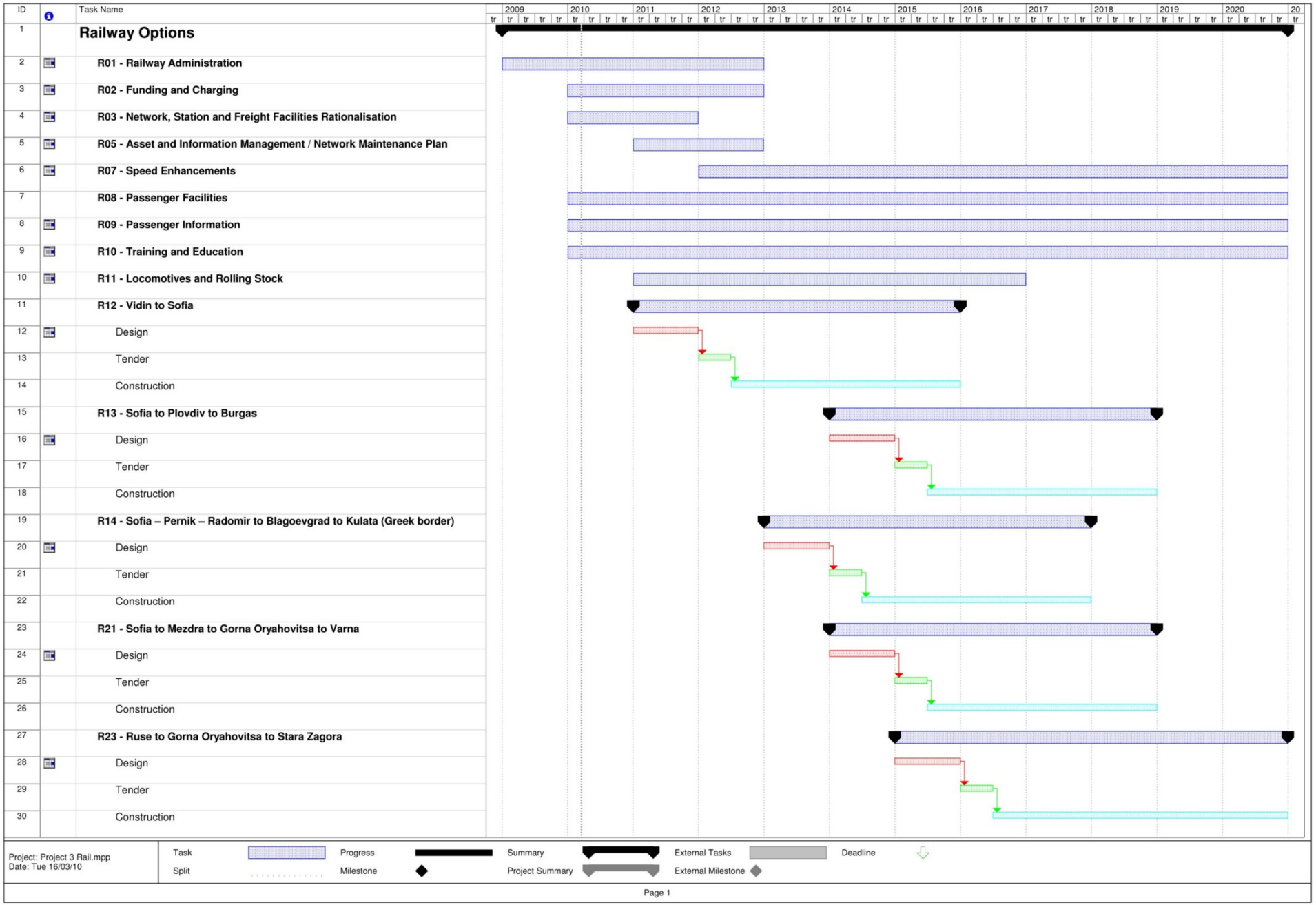
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3 R02 - Funding and Charging
4 R03 - Network, Station and Freight Facilities Rationalisation
5 R05 - Asset and Information Management / Network Maintenance Plan
6 R07 - Speed Enhancements
7 R08 - Passenger Facilities
8 R09 - Passenger Information
9 R10 - Training and Education
10 R11 - Locomotives and Rolling Stock
11 R12 - Vidin to Sofia
12 Design
13 Tender
14 Construction
15 R13 - Sofia to Plovdiv to Burgas
16 Design
17 Tender
18 Construction
19 R14 - Sofia – Pernik – Radomir to Blagoevgrad to Kulata (Greek border)
20 Design
21 Tender
22 Construction
23 R21 - Sofia to Mezdra to Gorna Oryahovitsa to Varna
24 Design
25 Tender
26 Construction
27 R23 - Ruse to Gorna Oryahovitsa to Stara Zagora
28 Design
29 Tender
30 Construction
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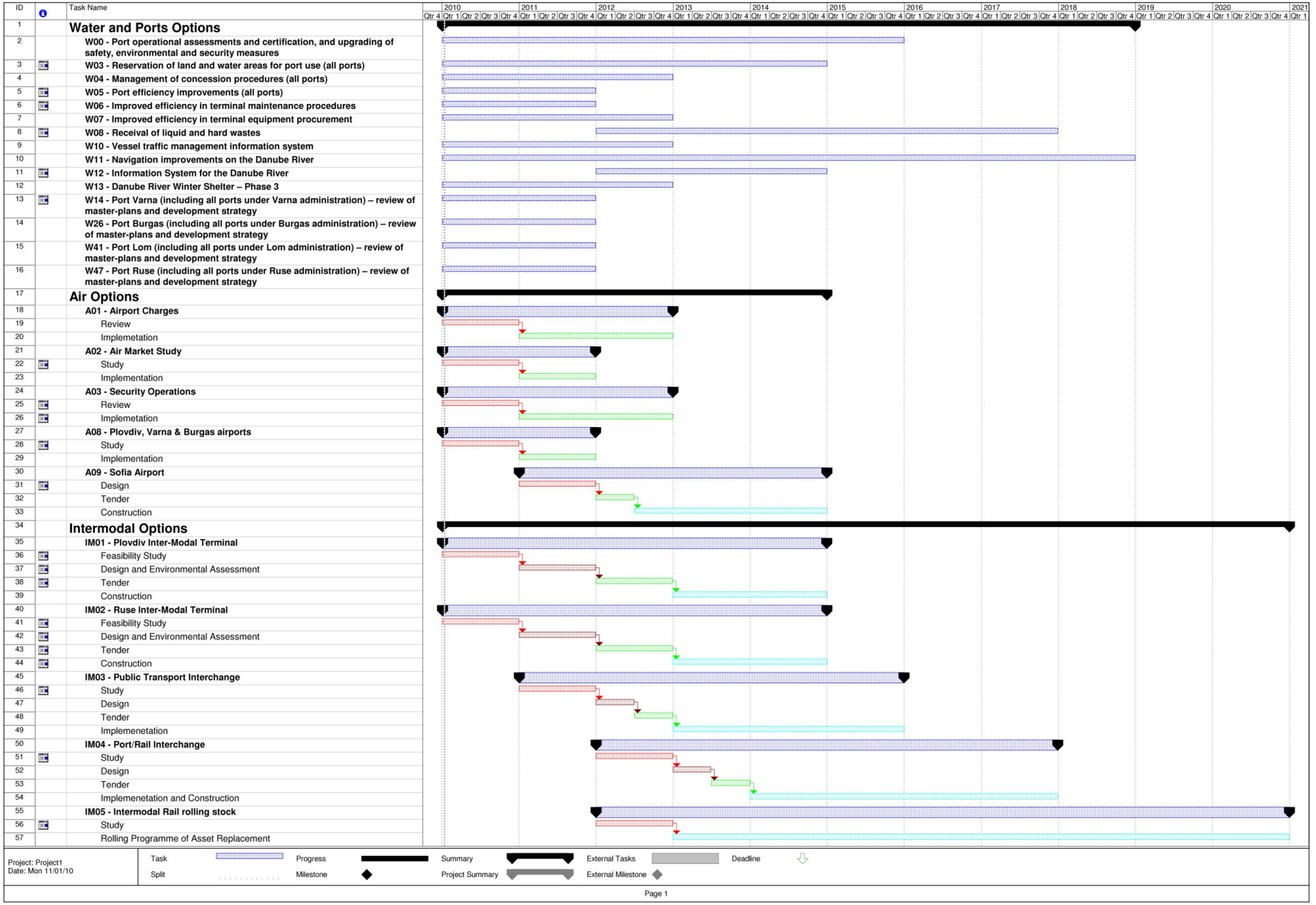
Page 1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1 Water and Ports Options
2 W00 - Port operational assessments and certification, and upgrading of safety, environmental and security measures
3 W03 - Reservation of land and water areas for port use (all ports)
4 W04 - Management of concession procedures (all ports)
5 W05 - Port efficiency improvements (all ports)
6 W06 - Improved efficiency in terminal maintenance procedures
7 W07 - Improved efficiency in terminal equipment procurement
8 W08 - Receival of liquid and hard wastes
9 W10 - Vessel traffic management information system
10 W11 - Navigation improvements on the Danube River
11 W12 - Information System for the Danube River
12 W13 - Danube River Winter Shelter – Phase 3
13 W14 - Port Varna (including all ports under Varna administration) – review of master-plans and development strategy
14 W26 - Port Burgas (including all ports under Burgas administration) – review of master-plans and development strategy
15 W41 - Port Lom (including all ports under Lom administration) – review of master-plans and development strategy
16 W47 - Port Ruse (including all ports under Ruse administration) – review of master-plans and development strategy
17 Air Options
18 A01 - Airport Charges
19 Review
20 Implemetation
21 A02 - Air Market Study
22 Study
23 Implementation
24 A03 - Security Operations
25 Review
26 Implemetation
27 A08 - Plovdiv, Varna & Burgas airports
28 Study
29 Implementation
30 A09 - Sofia Airport
31 Design
32 Tender
33 Construction
34 Intermodal Options
35 IM01 - Plovdiv Inter-Modal Terminal
36 Feasibility Study
37 Design and Environmental Assessment
38 Tender
39 Construction
40 IM02 - Ruse Inter-Modal Terminal
41 Feasibility Study
42 Design and Environmental Assessment
43 Tender
44 Construction
45 IM03 - Public Transport Interchange
46 Study
47 Design
48 Tender
49 Implemenetation
50 IM04 - Port/Rail Interchange
51 Study
52 Design
53 Tender
54 Implemenetation and Construction
55 IM05 - Intermodal Rail rolling stock
56 Study
57 Rolling Programme of Asset Replacement
Project: Project1
Date: Mon 11/01/10
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Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline
Page 1

10.4 Human Resources Development Strategy

10.4.1 Introduction

The implementation of the GTMP will have an impact on employment and human resources in Bulgaria because of the scale and scope of the projects involved. To assist in ensuring that the right skills are available, a strategy for developing human resources in the transport has been prepared. This section provides a summary of the work undertaken and the consultant's recommended strategy.

The strategy is based on a review of the current situation in the sector and identified strengths and weaknesses. This review included consultation with a wide range of relevant institutions, consumer representatives and academics. The strategy is consistent with the EC's "Lisbon Strategy for Growth and Jobs" launched in 2000 as a response to globalisation with the objective for the EU and its member countries to cooperate on reforms aimed at generating growth and more and better jobs by investing in people's skills, the greening of the economy and innovation. In terms of Transport, the Lisbon Strategy targets the development of transport infrastructure and liberalisation of transport services and the wide application of information and telecommunication technologies.

The transport sector plays a key role in the development of any modern society, being a means, not an objective of economic development and a prerequisite for achieving social and regional cohesion. Bulgaria's transport sector plays a crucial role in enhancing the competitiveness of the national economy and the public services. Transport generates 7.6% of gross value added of the country and provides direct employment to over 146,000 people (source: NSI). Overall, in recent years, there has been an increase in the demand for transport services - freight and passenger, as well as requirements for higher quality.

The strategy is aimed at:

- providing effective management of the most important asset of the transport sector – the people who work in it;
- satisfying citizens and businesses with the administrative services provided; and
- stimulating the development of key areas of human resources management.

The problems identified in terms of human resources in the transport sector are similar to those in most economic sectors in Bulgaria. The main cause of the problems is the existing gap between education and labour market needs. So the basic approach in preparing the strategy has been to identify causes and the possible solutions for providing a closer match between training and education, and the skills required by the industry.

10.4.2 Current Situation

10.4.2.1 Economic and Social Factors Affecting Human Resources in the Transport Sector

According to data from a national survey conducted by ING Pension Insurance and Alpha Research "Trends in labour market in a situation of economic crisis" during 2010 redundancies are expected in the construction sector (33% of employers in this sector), transport (25%), trade (25%) and manufacturing (20%). Serious cuts began in October 2009 in rail transport. Balancing the needs for an infrastructure and transport service on an internal regional level requires close coordination between the regional development and transport sectors on the one hand and education and training on the other.

There have been problems in the absorption of EU funds and funds from other international financial institutions for raising the qualification of human resources, for adequate manpower and for the implementation of priority infrastructure projects. Although some of the reasons for the very slow pace of preparation and implementation of priority infrastructure projects are external, the experience in recent years showed major deficiencies in human resources such as:

- lack of professional and administrative capacity and adequate training to implement all phases of project management: planning, preparation and realisation;
- limited resource of highly qualified personnel with professional skills in construction (shuttering workers, welders, etc.), even in this time of financial crisis. Good specialists still working in the country are already occupied, and the Bulgarians abroad do not seek work in Bulgaria and instead prefer other European countries or use their rights to receive unemployment benefits gained in countries such as Spain or Germany, which reach over €1,000 per month for up to two years; and
- lack of human resources to carry out systematic follow-up (ex-post) evaluation, which if carried out at all is done by foreign experts.

The construction industry in Bulgaria is in a deep crisis because of the global economic crisis. In the transport sector some construction continues, although with difficulties, notably roads and subway infrastructure.

The general trend in construction has been for cutting costs as much as possible. Training is undertaken only to meet statutory requirements, such as the Law on Health and Safety at Work and ISO standards. The difficulties have highlighted that overall the industry has worked inefficiently for a long period and the transition is now painful and not always successful. Companies which have worked with international organisations are a little better placed to deal with the problems.

The relationship between the transport sector and educational institutions is mainly through the participation of some teachers as project consultants rather than improving education. There are a relatively small number of well-trained staff especially younger people. These are mainly engineers and architects who speak foreign languages and are influenced by foreign companies.

Modern management is scarce in the industry because universities prepare professionals who can build infrastructure, but who are not trained to manage people. Maintaining infrastructure in good condition is an important, but not well resolved issue. In order for this to be done successfully and profitably, facilities management companies should be included in the construction process.

Development of infrastructure projects is closely related to the capacity of managerial, administrative and executive personnel. Whilst some project management skills exist at local level, there is a clear need to attract foreign experts for key managerial positions.

The current situation in the labour market, which is mainly a consequence of the global financial crisis, is beneficial to future contractors, because they can execute their projects without needing to attract high-skilled blue-collar workers from neighbouring countries to execute specific activities. The faster the implementation of infrastructure projects starts, the sooner the recovery of the construction sector will start.

The need to attract labour from outside Bulgaria is very small, given the current state of the labour market in the country and the expectations for double digit unemployment rates in 2010 (projected by the Ministry of Labour and Social Policy). Nevertheless it would be beneficial, when concluding contracts for employing foreign highly qualified staff, to include a provision for the foreign companies' to train a certain percentage of Bulgarian specialists in order to have local skills to manage and deliver future projects.

In 2009 a significant number of Bulgarians who had been working in construction outside the country returned to Bulgaria to seek work on Bulgarian sites and projects, but most were unsuccessful. The number of such workers according to unofficial data is about 50,000. There is very little chance of those returning from abroad and Bulgarian unemployed finding further work abroad. There is a significant reduction in the number of job advertisements for jobs within the EU posted on the European jobs mobility website (EURES); the ratio of the number of jobs advertised to the number of registered candidates is more than 1 / 1000 so it is reasonable to expect more Bulgarians to be looking for employment in Bulgaria.

10.4.2.2 Workforce and Salaries

The last in-depth analysis of the workforce in the transport sector was carried out in May 2006 by the Bulgarian Industrial Association. **Table 10.4** below presents changes in employment and average insurable earnings during the period January - May 2006 compared to the same period of 2005.

Table 10.4 – Employment and Earnings in Different Transport Sectors

	Rail	Other Land Transport	Water	Air	Auxiliary Activities
Number of Employees	31,478	48,864	6,744	5,221	12,905
Change 2005 to 2006	4,822	3,766	- 553	- 1,112	468
Average Earnings (€/month)	324	252	554	826	480
Change 2005 to 2006 (€)	18	9	114	208	45

Source: Bulgarian Industrial Association

Unfortunately, no data for the period 2007 - 2009, reflecting the changes occurring after the country's accession to the European Union, is available. There are also no studies focused on the consequences of

the global economic crisis. Such studies would be a key tool for determining the link between labour demand and supply and the diminishing differences between the two.

For the purposes of developing the strategy, publicly available information was used to determine additional trends in the labour force in recent years. Several significant conclusions from this research can be drawn:

- Lack of people with practical skills and experience;
- High percentage of employees working in the "grey" labour market;
- Inadequate education level of employees in the sector and the absence of a consistent trend of increasing professional qualifications of the staff;
- Underdeveloped key competencies of employees in the sector, especially in terms of language knowledge, computer literacy and experience to work with EU funds;
- Relatively low motivation among some of the employees due to low remuneration, poor work organisation, subjective performance evaluation; and
- High turnover of staff.

There is also a 20% difference between the desired and the offered salary in the transport and logistics sector. The figures are based on the advertisements published on www.JobTiger.bg for the period September 2008 - September 2009 and on information given by job seekers about the pay they desire. The average monthly offered salary is BGN 700 and the average desired salary is BGN 850.

10.4.2.3 Education

In the transport sector, characterised by a large number of aging workers especially in state-owned enterprises, the education trends do not differ from those in the country as a whole. The education and training of employees and potential new workers in the transport system lags behind the more dynamic development of the sector. Continuing vocational training in the country is performed by institutions of formal education and training and informal learning. Key institutions providing continuing vocational education, informal education and training under the Act of Professional Education and Training are:

- vocational schools;
- vocational high schools;
- vocational colleges; and
- vocational training centres (CVT).

In 2009 the network of vocational schools in the country included 93 transport vocational high schools out of 456 vocational schools, of which only one is private. Applicants' interest in these schools is, however, very low and they train mainly students who have not been accepted in other schools or who come from traditional sector-oriented families (families in which previous generations have been employed in the sector).

Higher education is provided by universities. All higher education institutions (51) in Bulgaria have set up units at postgraduate level, and offer training in professions and specialties for people over 16 years. With regard to higher education, the situation concerning the transport sector is similar to secondary education. According to one of the interviewed teachers with long experience in Kableshkov Higher School, the number of professionals trained in road construction is at least three times lower than the market demand. **Table 10.5** below shows the number of students and doctoral students trained in transport by the universities.

Table 10.5 - Number of students in school year 2009/2010 prepared for implementation in the transport sector with professional knowledge in the field

High School	Professional Field	Number of Students - Undergraduate and Graduate				Total Students
		Diploma	BA/BSc	MA/MSc	PhD	
Technical University - Varna	Transport, shipping and aviation	54	632	596	0	1,282
Technical University - Varna	Transportation	0	0	0	11	11
Naval Academy "Nikola Vaptsarov" - Varna	Transport, shipping and aviation	0	1,150	307	0	1,457
Naval Academy "Nikola Vaptsarov" - Varna	Transportation	0	0	0	3	3
National Military University "Vasil Levski" - Veliko Tarnovo	Transport, shipping and aviation	0	29	3	0	32
University of Plovdiv “Paisii Hilendarski "	Transport, shipping and aviation	42	0	0	0	42
University of Ruse "Angel Kanchev"	Transport, shipping and aviation	0	677	200	0	877
University of Ruse "Angel Kanchev"	Transportation	0	0	0	7	7
Technical University - Sofia	Transport, shipping and aviation	0	831	144	0	975
Higher School of Transport – “Todor Kableshkov”	Economy	50	70	124	0	244
Higher School of Transport – “Todor Kableshkov”	Mechanical Engineering	31	257	51	0	339
Higher School of Transport – “Todor Kableshkov”	Electrical, Electronics and Automation	31	178	103	0	312
Higher School of Transport – “Todor Kableshkov”	Communications and Computer Engineering	37	195	79	0	311
Higher School of Transport – “Todor Kableshkov”	Transport, shipping and aviation	28	207	125	0	360
Higher School of Transport – “Todor Kableshkov”	Architecture, Engineering and Surveying	37	238	52	0	327
Higher School of Transport – “Todor Kableshkov”	Transportation	0	0	0	3	3
Higher School of Transport – “Todor Kableshkov”	Construction	0	0	0	4	4
University of Shumen "Episkop Konstantin Preslavski"	Architecture, Engineering and Surveying	0	93	0	0	93
Higher school of civil engineering “Liuben Karavelov”	Architecture, Engineering and Surveying	77	782	233	0	1,092
Higher school of civil engineering “Liuben Karavelov”	Construction	0	0	0	6	6
University of Architecture, Civil Engineering and Geodesy	Architecture, Engineering and Surveying	0	157	4,134	0	4,291
University of Architecture, Civil Engineering and Geodesy	Construction	0	0	0	17	17
University of National and World Economy	Economy of Transport	0	167	30	0	197
Total students in the fields of transport		**387**	**5,663**	**6,181**	**51**	**12,282**
Total Students		**28,295**	**157,748**	**65,010**	**2,446**	**253,499**
% rate		**1.37%**	**3.59%**	**9.51%**	**2.09%**	**4.84%**

Companies also conduct informal continuing training of their employees and informal continuing vocational education is offered by culture centres but this is done very rarely. These traditional Bulgarian cultural-educational institutions typically organise activities to expand the knowledge of the citizens and to acquaint them with the achievements of science, art and culture. In smaller towns and villages they are the only ones that provide access to a library, internet connection and information. Therefore, they need to be supported with regard to the development of continuing vocational education.

10.4.2.4 The views of companies and educational institutions

In order to study the opinion of representatives on both sides of supply and demand of human resources in the transport sector, meetings were held with representatives of employers and educational institutions.

During the meetings with employers the following issues were discussed:

- Key and professional skills of employees in the organisation;
- Ways of training and re-training;
- Recruitment strategy and human resources management strategy; and
- Quality of new recruits, particularly those who have recently completed their studies.

The principal conclusions from these meetings were as follows:

- There is still a huge difference in terms of human resources management in private and in public companies. While private companies have started to develop a comprehensive policy on human resources management, public companies have changed little in recent years;
- Professional skills of new graduates who have just finished their studies have deteriorated and thus investment in on-the-job training is required;
- State-owned companies are directly dependent on the Ministry of Transport, Information Technology and Communications and are limited in their ability to implement long-term policies, because of the frequent changes in administration;
- There is a lack of long-term vision for the sector development and no consensus on adhering to the strategy in order to achieve results;
- With regard to the transport sub-sectors which operate at a loss, there is a serious problem with qualified employees, who move to competing private companies or prefer to seek job opportunities outside the transport sector. Aging staff and lack of new employees willing to work at current compensation levels is a serious problem in the railway system;
- The transport sector as a whole is not sufficiently attractive as an employer, so highly skilled professionals with specific skills (casing, welders, and technical managers) seek job opportunities abroad. In particular, social packages offered by the employers in the sector are basic and rarely include voluntary retirement or health insurance benefits;
- Employers are concerned primarily about the level of professional skills and do not appreciate the need to develop key skills that are becoming increasingly important for the implementation of strategic change and development such as communication skills, team effectiveness, project management, and leadership.

During the meetings with representatives of educational institutions the following issues were discussed:

- Opportunities for adequate personnel training to match labour market needs;
- Cooperation with business;
- Job opportunities for graduates; and
- Opportunities for lifelong learning.

Representatives of educational institutions saw the development of human resources in the transport sector in the following manner:

- Due to the mechanisms for financing, most educational institutions are concerned only about attracting students, while the adequacy of the proposed programmes and their relevance to labour market demands are neglected;
- Students who are trained in transport and construction disciplines are not motivated to start working in the transport sector after they graduate;
- The educational level of the new students is increasingly weak and requires additional training in general subjects such as mathematics; and
- The lack of practical skills and internships for graduates is still a serious problem for both sides, despite their willingness to resolve it.

10.4.3 SWOT Analysis

10.4.3.1 Background

The analysis of the human capital in Bulgaria's transport system has been the basis for assessing the strengths and the weaknesses at the moment and the threats and the opportunities for future development. A SWOT analysis has underpinned the formulation of priorities and measures for the strategy for management and development of human resources in the transport sector. Identified strengths, weaknesses, opportunities and threats are summarised in the following sections.

10.4.3.2 Strengths

1. Developing a strategy for human resources management and development is a part of a General Transport Master Plan.
2. There is an existing administrative and organisational structure of human resources in the public administration sector.
3. The majority of medium and large companies have structures related to human resources management.
4. There are projects for development and modernisation of the transport sector, some of which are in progress.
5. There is a system for vocational education and retraining of personnel in all main transport sub-sectors, especially working well for rail and water transport.
6. There is continuity between generations, and loyalty to the transport sub-sectors, especially in rail and maritime transport, which is one of the reasons for attracting young people.
7. There is a national network of vocational schools and high schools that offer good theoretical technical education.
8. There is a network of authorised training centres that offer continuing educational opportunities.

10.4.3.3 Weaknesses

1. Lack of vision in planning and management of human resources at different levels.
2. Insufficient coordination between modes and between public authorities and contractors, leading to lack of an integrated approach in managing the workforce.
3. Aging generation with many employees approaching retirement age.
4. Lack of human resources to create and manage a sustainable, clear system and regulatory framework for planning, implementing and maintaining road infrastructure projects.
5. Low motivation to work in the sector. Well trained and qualified professionals are not motivated to work because there is inadequate pay and no clear strategy for professional and personal development. As a result of this lack of motivation the quality of transport services is generally low.
6. Shortage of professional and administrative capacity at the managerial level, responsible for the modern requirements in the sector, particularly for management and implementation of large infrastructure projects.
7. Unclear long-term commitment of the state to funding of infrastructure and public services associated with it, including continuing training and qualification of staff.
8. There are no short-term and long-term analysis and forecasts for the needs of personnel with relevant skills and knowledge for the effective functioning of the sector.
9. The relationship between education and training institutions and the transport sector is not functioning effectively enough. As a result there is a lack of personnel with the necessary knowledge and skills and additional investment in training by employers is required.
10. Development of key competences is not a recognised priority for educational institutions and employers.
11. Low level of knowledge and practical use of information and telecommunication technologies in the sector.
12. Knowing at least one foreign language is a major problem for employees in certain positions. This slows down the deployment of inter-operability and management systems particularly in the rail and road transport.
13. Low funding, both public and private, for research and development in universities leading to very few researchers with results hard to be applied in practice.

10.4.3.4 Opportunities

1. Creating a long-term strategy for human resources development in the transport sector which will lead to development and implementation of such strategies for each mode.
2. Recognising the strategic role of HR managers at the state level and in companies.
3. Integrating the transport system and in particular the management strategy and human resource development strategy with the EU and neighbouring countries can lead to additional opportunities for professional development of employees.
4. Career guidance and career development on corporate and sectoral levels are a top priority in the HR development strategy. Identifying key employees and developing programmes to increase levels of motivation and retention.
5. Effective use of lifelong learning opportunities – in company training can be funded under the Human Resources and Transport Operational Programmes, coordinated by the Education, Audiovisual and Culture Executive Agency.
6. Improving the relationship between employers and educational institutions - modernisation of curricula and plans, providing opportunities for practical training and experience during the study process. Establishing a mechanism for assessing the future needs of certain knowledge and skills and its integration in determining the number of new students to be enrolled in different courses.
7. Priority setting – creating opportunity for language learning for employees in the industry, training of middle and senior management on decision making and entrepreneurship, social and civic competencies and development of learning skills among highly qualified key personnel.
8. Completing the curricula of universities and vocational schools with mandatory and elective courses in people management and project management, economics and other business related classes.
9. Creating programmes for education and training in infrastructure maintenance and attracting people willing to work in this area.
10. Maintaining an effective social dialogue. Promotion of professional and trade organisations as a partner in human resources development.
11. Introduction of modern methods for managing human resources, including investments in new technologies.
12. Transfer of good practices from Bulgarian and foreign private investors and operators into the state sector. Greater use of public-private partnership.
13. The current economic crisis and down-turn in construction activity has resulted in the ready availability of experienced Bulgarian construction workers who will be available to meet the demand from new transport projects.

10.4.3.5 Threats

1. Delay in the reform and modernisation of the sector or some sub-sectors.
2. Frequent restructuring of some organisations prevents the achievement of the desired sustainable results.
3. Allocation of funding on annual basis and insufficient funds for human resources management and development.
4. Focusing only on the development of international transport and ignoring the needs at a national, regional or domestic level which leads to underestimation of the resources required for training the staff servicing the national transport system.
5. Curricula continue to be developed on the basis of the available teaching capacity, rather than the needs of the labour market.
6. Delay in the implementation of priority projects, leading to loss of skilled labour.
7. Demographic problems in the country and unattractiveness of the sector as an employer may lead to the closure of disciplines and even entire universities and vocational schools.
8. The universities do not see their future development as a centre of excellence.

10.4.4 Human Resources Strategy

10.4.4.1 General Requirements

To implement a strategy for human resource management, development and strategic planning on its own is not enough; creating a good organisation focused on implementing the strategy is also required. In this

sense, human capital management must be tied to the overall development strategy in the transport sector and human resource managers should be included in the effective management of business processes.

The success of the strategy at all levels depends on the active support of society and its awareness of the importance and provision of sufficient time to achieve desired results. The correct formulation of the strategy is in the best case only half of the work required for its realisation. The management team's ability to translate these complex and common long-term intentions into concrete, clear, measurable goals and to allow space for action is of critical importance. The strengths and opportunities available as well as the following measures must be taken into account when developing the strategy.

10.4.4.2 Strategy Measures

The strategy comprises of six principal measures:

Measure 1 - Quality management of human resources at all levels to achieve a proper and rational use of public funds:

i. Linking project realisation with the necessary human resources for effective priority setting for infrastructure projects and government programmes.

ii. Introduction of tools for monitoring the implementation process of the strategy and the priorities set out therein.

iii. Introduction of remuneration policies related to employees individual and team performance.

iv. Expanding opportunities for flexible employment schemes.

Measure 2 - Professional Development

i. Reducing the political influence over the human resources management within the sector:
   - rules that ensure job security;
   - strengthening social dialogue between trade unions and professional organisations and the employers in the transport sector.

ii. Raising the effectiveness and efficiency of recruitment and selection systems and appointment and dismissal of employees:
   - succession planning;
   - development of adequate competence models for recruitment and performance evaluation;
   - changes in legislation to ensure stable employment and mobility.

iii. Effective policies to improve training, in line with the development of the sector:
   - increasing stakeholders' commitment to the process of change;
   - improvement and development of vocational and key skills and qualifications of employees in the transport system;
   - Increasing investment in training. The objective is for the training budget to reach up to 3 - 5% of the payroll on an annual basis following the example of European best practices;
   - Contracts for employing foreign qualified staff to include a provision for the foreign companies to train a certain percentage of Bulgarian specialists in order to have local skills to manage and deliver future projects.

iv. Development of a new appraisal system:
   - The appraisal should rely on feedback from internal and external clients in order to achieve objective assessment;
   - improving performance evaluation systems, with emphasis on the hierarchy of objectives.

v. Development of an effective and transparent system of career management:
   - opportunities for career development;
   - succession planning.

Measure 3 - Develop leaders capable of achieving the strategic objectives for sector development through effective human resource management

i. High professionalism and efficiency in senior management activities.

ii. Strengthening the role of leaders in order to position the companies in the sector as attractive employers:
   - promoting and tolerating a working environment appropriate to the values and principles of the transport sector;
   - stimulating the development of teamwork and continuity in work planning and tasks execution;
   - implementation of behavioural and cultural change - a new organisational culture;
   - knowledge and use of the full potential of human resources.

Measure 4 - Improving the capacity of HR departments in the transport sector and their transformation into a strategic partner in the governmental sector

i. Optimising human resources management at a central, regional local and corporate level and creating a tradition of best practice sharing.
ii. Introducing professional standard HR departments in the transport sector.
iii. Using well established tools and methods for human resources management.

Measure 5 - Motivating employees to achieve the required quality and efficiency

i. Stimulating participation of every employee in the management process.
ii. Establishing a social status of employees, consistent with certain responsibilities and restrictions.
iii. Improving teamwork and communication at all levels.

Measure 6 - Application of modern concepts of quality management in human resources management in the transport sector

i. Introducing systems for quality management and methods of organisational excellence.
ii. Sharing best practice.

10.4.4.3 Strategy Implementation

A clearly defined and transparent process of implementation of the human resources management strategy will be vital to its adoption and long-term success. Key elements of the implementation process will include:

- Discussions at any stage of the implementation process with all stakeholders in the sector, identifying expected outcomes and forms of control;
- Clear definition of responsibilities for achieving the goals;
- Establishing a mechanism for coordinating the accountability of results;
- Support from social partners and constructive dialogue with them;
- Good communication approach to familiarise the society with the objectives, the public benefits and the results of implementing the strategy;
- Clear financial commitment to ongoing changes; and
- Commitment at all levels to support change and achieve results.

10.4.4.4 Strategy Monitoring

A monitoring system should be developed to track the success of the proposed measures included in the strategy. It should outline key performance indicators, impact assessment and results evaluation. Possible indicators according to the specifics of the activities are:

- Percentage of tasks executed within a certain period of time;
- Increased number of people willing to work in the transport system;
- Growth rate of the wages in the transport sector;
- Motivation of employees – higher motivation and higher number of motivated employees;
- Reduced turnover;
- Proportion of employees that have passed various forms of education to the total number of employees for the period;
- A growing percentage of people who have successfully completed their training;
- Increased satisfaction with the training conducted;
- Increased utilisation of resources for training;

- Number of newly created and updated curricula in accordance with the training needs analysis;
- Number of newly developed and implemented HR management and development systems in the transport sector; and
- Indicators for self-assessment of the human resources management by directly involved employees.

10.4.4.5 Strategy Funding

To maximise the effectiveness and the efficiency of the process, a mechanism for coordinating the activities and the financial resources for development of human resources, should be established. In addition to national funding, applying for grants from the European Social Fund, and the European Globalisation Adjustment Fund for the financing of specific actions to re-integrate workers made redundant as a result of restructuring into the labour market could be used.

Specific funding programmes available include the Operational Programme "Human Resources"; Operational Programme "Transport"; and Operational Programme Administrative Capacity and Programmes for Lifelong Learning, coordinated by the Education, Audiovisual and Culture Executive Agency.

10.4.5 Summary

The transport sector at present is not attractive to highly qualified specialists and is threatened by demographic, social and economic problems and a lack of succession. Educational institutions are making partial efforts to offer courses more appropriate to the needs of the transport sector but still rely heavily on their aging teaching staff.

The main strategic recommendation is for the development of a comprehensive strategy for human resources management and development in the transport sector, which responds to contemporary standards of governance and human development. The strategy should provide a unified vision for the development of the transport sector, but also take into account the different features of each sub-sector.

If, due to lack of resources and/or political will, this strategy cannot be developed and delivered in full at this stage it is important to initiate steps to maintain the existing quality of human resources which is crucial for successful implementation of the General Transport Master Plan for Bulgaria. Procedures for development of unified job descriptions, levels of compensation, procedures for staff evaluation and assessment should start as initial efforts for future human resource management based on existing international good practices.

10.5 Monitoring and Evaluation Strategy

10.5.1 Introduction

An important requirement in developing the GTMP is the preparation of a strategy for the monitoring and evaluation of the plan and each project within it. The monitoring and evaluation strategy has been designed to assess whether each project has been implemented on time, to budget and to the specified standard. The process of monitoring and evaluation will be ongoing so as to ensure that the plan continues to deliver the quality of service that is expected and that projects are successful in delivering the benefits that were forecast during their appraisal.

This section explains AECOM's recommended monitoring and evaluation process, the data required, and the methods to be adopted.

Measures for specific environmental monitoring and control in compliance with the opinion of the MoE&W (№ 1-1/y. 2010) have been considered separately and are referenced and quoted in section 9.8.7. These will form an integral part of the overall monitoring and evaluation strategy.

10.5.2 Monitoring and Evaluation Process

The major goal of evaluation of the OPT and GTMP is to influence decision-making or policy formulation through the provision of empirically driven feedback.

Five main categories of evaluation benefits can be identified:

- Improved planning – such as improvements to appraisal methods;
- Enhanced implementation procedures – such as a greater understanding of project risks;
- Strengthening of the institutional relationships required to deliver projects – such as links between member States and the European Commission;
- Better accountability – evidence to show that investment programmes are delivering social and economic benefits; and
- Improved production of knowledge - to support continuous improvement.

There are three key procedures as far as the Monitoring and Evaluation Strategy is concerned within the overall process of the Master Plan Implementation:

- Ex-ante evaluation – which takes place before project implementation, at the project planning stage and contains the best prior estimate of:
  - The physical definition of the project;
  - The cost of the project;
  - The outputs of the project;
  - The outcomes of the project; and
  - A cost-benefit analysis.
- The Monitoring process – collection of relevant outturn information to enable the ex-post evaluation to take place.
- Ex-post evaluation - that takes place after project implementation comparing the outturn outputs and outcomes with the ex-ante evaluation estimated at the project planning stage.

Monitoring and evaluation will play three key roles:

- It will allow the Ministry of Transport, Information Technology and Communications to identify poorly performing projects so that corrective action can be taken;
- It will provide information that will assist in improving the specification and delivery of future projects; and
- It will be a requirement for EU funding.

For the purposes of monitoring and evaluation it has been necessary to develop monitoring indicators which cover, but are not limited to, those indicators laid down in the OPT. Such indicators for instance are evolution of modal share and evolution of the passenger and freight traffic. Examples will include:

- the number of passengers and passenger/km;
- freight tonnes transported and tonne/km;
- traffic density (e.g. number of trains);
- overall profitability of passenger and freight market segments;
- creation of new transport and value-added services; and
- creation of jobs.

Monitoring and evaluation will be required both at the individual project level and at the level of the Master Plan strategy as a whole.

10.5.3 EU Requirements for Evaluation and Monitoring of the OPT

The General Transport Master Plan (GTMP) should ideally have preceded the OPT, which should have been developed within the context of the GTMP. However, the GTMP includes the infrastructure provisions of the OPT, and extends the scope to include Air Transport, Network wide Information and Control systems, and institutional and administrative reforms. Clearly there is no point in setting up parallel systems of monitoring for the OPT and the GTMP. It is the intention therefore that the data collected as part of the GTMP monitoring system will meet the needs of the OPT monitoring required by the EU.

Evaluation of the OPT will comprise two elements:

- An external evaluation focussing on both operational and strategic issues to review overall progress and performance and the level of absorption of financial resources and physical progress; and
- An interim evaluation and assessment of the contribution of the OPT to the attainment of the goals of the “Lisbon Strategy for Growth and Jobs”. The interim evaluation will be required as an input to the strategic report to be submitted to the European Commission by the first half of 2012.

Typical OPT evaluation “issues” are set out in **Table 10.6**.

Table 10.6 - Main OPT Evaluation Issues and Questions

Main Issues	Key Evaluation Questions
Overall Evaluation of OPT Effectiveness and Impact	
Overall financial progress	Analysis of financial progress against target at OPT and priority axis level. Identification of barriers and problems in the absorption of funds.
Analysis of external developments	Main developments in transport sector and in traffic volumes across key transport modes. Developments in transport and other policies at national and EU level. Implications of above developments for OPT implementation and strategy.
Physical progress	Rate of overall physical progress by reference to output and result indicators. Analysis of factors affecting progress.
Implementation arrangements	Adequacy of existing arrangements for OPT implementation. Capacity of Final Beneficiary level.
OPT management and monitoring	Is the monitoring system providing reliable information on a timely basis? Performance of Managing Authority.
Progress towards achieving OPT goals and wider impacts	Extent of integration between national and European transport networks What progress has been made to reduce the load on the road infrastructure? Is a better balance between different types of transport being achieved? What progress has been achieved towards a sustainable transport system?
Progress towards achievement of NSRF Priorities	What is the programmes contribution to sustainable development policy? What is the contribution towards achievement of stable economic growth? What is the contribution of the OPT to employment? What is the impact of programme on regional development?
Interim evaluation of OPT progress and programme performance	
Review of developments in Lisbon strategy	Implications of new policy orientations for OPT
Achievement of Lisbon strategy goals resulting from development of the transport sector	Extent of development of trans-European transport corridors. Level of integration with the trans-European transport system
Influence on protection of the environment	Contribution to environmental protection
Social policy impacts	Number and quality of created jobs
Economic impacts	Contribution to economic development at national and regional levels

10.5.4 *GTMP Evaluation Requirements*

Whilst the examples of evaluation issues given in Table 10.6 do not necessarily cover the full range of evaluation reports required by the European Commission in respect of the OPT, they do contain the range of topics the Commission wishes to be evaluated. There are, however, three important differences between the OPT and Master Plan evaluations:

- The OPT is mainly concerned with the implementation of the Operational Programme as a whole, and its impacts at a macro-level on the Bulgarian economy, employment, and environment, whereas the Master Plan will concentrate on projects and corridors;
- The OPT emphasises the compatibility between the Policy Objectives of the EU, in particular the provisions of the Lisbon Treaty and the integration of Bulgaria's transport system into the TEN-T. The Master Plan is a National Master Plan and addresses national needs and priorities, and, while being consistent with EU policy and addressing TEN-T integration, is not solely concerned with these European-wide objectives; and
- Whilst the OPT evaluation is concerned in part with the management processes of implementing the Programme, the Master Plan recognises the importance of institutional and administrative efficiency, but in the field of transport management, as well as the administration of the Master Plan itself.

10.5.5 *Monitoring and Evaluation of Mater Plan Projects*

The projects within the Master Plan are designed to form a coherent and integrated plan. They consist of different types of project and different modes of transport. All of the potential combinations of intervention type and mode will require monitoring and evaluation. The type of projects for which monitoring and evaluation is most clearly definable are the infrastructure projects. These have clear, visible physical characteristics and measurable outputs, their costs are usually identifiable in public accounting systems, and reasonable estimates may be made of their benefits and environmental impacts.

On the other hand the preparation of studies and plans in themselves have no outputs or outcomes, other than reports, until they are actually implemented and become physical projects which are capable of being monitored and evaluated more fully. Institutional reform is similar; while such reforms should have an impact on the efficiency of the organisation the actual measurement of the cost saving or greater output in the organisation is difficult to isolate.

The monitoring system has been kept as simple as possible. For all types of projects some financial monitoring, and the physical monitoring of progress are essential. But for the other types of monitoring, where outputs and outcomes are difficult to identify, or where surveys of users and stakeholders are required, a more limited monitoring and evaluation is recommended.

The type of monitoring that each project type will require is set out in **Table 10.7** below.

Table 10.7 - Type of Monitoring Required by Project Type

	Financial Monitoring	Physical Monitoring	Output Monitoring	Outcome Monitoring	Cost Benefit	Sustainability Monitoring
New Infrastructure	✓	✓	✓	✓	✓	✓
Maintenance & Rehabilitation	✓	✓	✓	✓	✓	✓
Network Strategies	✓	✓	✓	✓		
Control & Information Systems	✓	✓	✓	✓		
Management /Institutional Systems	✓	✓	✓	✓		
Education & Training	✓	✓		✓		
Further Strategy Plans	✓	✓				

10.5.6 *Monitoring and Evaluation Measures*

Table 10.7 introduced the concept of the various forms of monitoring and evaluation. These need to be developed further to identify what quantities would be measured under each of the main headings.

10.5.6.1 Financial Monitoring

Financial monitoring is relatively straightforward. It concerns the financial resources expended on each project, and if the project forms part of a corridor improvement, the cumulative expenditure. The need for financial monitoring is important for both funding organisations and the implementing bodies for two reasons:

- the financing authority or organisations, including organisations such as the EIB and private banks as well as public sector bodies, need to know that the allocated funds are being spent on the project to which they were allocated; and
- the implementing bodies need to monitor expenditure against budget and take timely corrective action if required.

Our recommended measures for financial monitoring, which give an indication of value for money, include three categories:

- **Overall Project Cost -** this will record how overall costs compare with budgeted costs. This measure will apply to the full range of projects, from major infrastructure projects through to further studies.

- **Capital Costs** – divided into land costs and construction costs. This measure would apply to those projects with a significant capital spend, that is projects which consist primarily of new infrastructure, maintenance and rehabilitation, and control and information systems.
- **Operating and Maintenance Costs** – to allow measurement of improved efficiency in operations.
- **Unit Costs (Key Performance Indicators - KPI) -** to assess value for money and to allow meaningful comparisons between different projects to be made.

Table 10.8 sets out a summary of our recommendations regarding financial monitoring.

Table 10.8 - Financial Monitoring

Type of Intervention	New Infrastructure	Maintenance/ Rehabilitation	Network Strategies	Control & Information Systems	Management /Institutional Systems	Education & Training	Further Strategy Plans
Overall project Cost	✓	✓	✓	✓	✓	✓	✓
Capital Cost							
Land	✓	✓		✓			
Construction Cost	✓	✓		✓			
Operating and Maintenance Costs							
Operating	✓		✓	✓			
Maintenance	✓	✓					
Unit Costs (KPI)							
Cost per lane km	✓	✓	✓				
Cost per track km	✓	✓					
Cost per terminal equipped				✓			
Cost per sq. m. of bridge	✓	✓					
Cost per metre of tunnel	✓	✓					
Cost per m^2 Buildings, runways, quays, storage	✓	✓					

10.5.6.2 Physical Monitoring

Physical monitoring will measure the real, visible, products of the project. This is most easily understood in the context of infrastructure projects where the products are a new road, railway, intermodal terminal or port quay for example. But clearly a passenger information system also produces displays of train or bus/tram times, a navigation system produces appropriate equipment, and so on. The concept can be extended to studies, where the physical product is a report or series of recommendations.

Our recommended measures for physical monitoring include two categories:

- Capital Projects - Master Plan projects which produce a physical, visible output; and
- Studies and Analyses - which involve institutional reform, education and training, or a strategy.

Our recommendations for Physical Monitoring are summarised out in **Table 10.9.**

Table 10.9 - Physical Monitoring

Type of Intervention	New Infrastructure	Maintenance/ Rehabilitation	Network Strategies	Control & Information Systems	Management /Institutional Systems	Education & Training	Further Strategy Plans
Physical Monitoring	✓	✓	✓	✓	✓	✓	✓
Capital projects							
% Completion of Project / Programme / Corridor	✓	✓	✓	✓	✓	✓	✓
Lane kms completed / upgraded	✓	✓					
Track kms completed / upgraded	✓	✓					
No. of junctions remodelled: (rail & road)	✓	✓					
Stations / Terminals equipped				✓			
m^2 Buildings, runways, quays, storage	✓	✓					
Studies & Analysis							
Reports / Recommendations produced					✓	✓	✓
Recommendations Accepted and Programmed					✓	✓	✓

10.5.6.3 Output Monitoring

Outputs are what the physical features of the project actually produce. For example, roads carry vehicles, people and freight; railways carry trains, people and freight; intermodal terminals process tonnes of freight. In other words the outputs measure the usage of the new or improved facilities.

The outputs to be monitored proposed fall into three categories:

- **Additional capacity provided** - this is a simple measure of the theoretical capacity of the new or improved facility;
- **Flows of vehicles, people or goods** - that the facility actually carries;
- **Utilisation of the capacity** - giving a straightforward indicator of the efficiency of the project.

Our recommendations for output monitoring are summarised in **Table 10.10.**

Table 10.10 - Output Monitoring

Type of Intervention	New Infrastructure	Maintenance/ Rehabilitation	Network Strategies	Control & Information Systems	Management /Institutional Systems	Education & Training	Further Strategy Plans
Output Monitoring	✓	✓	✓	✓	✓		
Additional Capacity							
Vehicles / day	✓	✓		✓			
Trains / day	✓	✓		✓			
Aircraft movements / day	✓	✓		✓			
Ship Movements / day	✓	✓		✓			
Kms of road surveyed			✓				
Kms of coast/river supervised				✓			
% covered by safety/ security system				✓			
Flows							
Vehicles/day	✓	✓					
Passenger kms	✓	✓					
Tonnes / tonne kms	✓	✓					
Freight throughput TEU / week	✓	✓					
% capacity utilised (Vol / Cap ratios)							
Road	✓	✓					
Rail	✓	✓					
Take-off / landings	✓	✓					
Freight throughput TEU / week	✓	✓					

10.5.6.4 Outcome Monitoring

The overall goals of the Master Plan concern improving transport efficiency and economic development, producing sustainable development and effecting a change in mode of travel towards more energy efficient modes. These indirect effects of the Master Plan projects are termed outcomes.

Of themselves, the **outputs** of the projects do not enable us to answer these questions. The project **outcomes** are designed to provide measures of the effectiveness of the projects in meeting these wider objectives.

Our recommended measures for outcome monitoring include two categories, first those which are Key Performance Indicators (KPI) for the transport system; and secondly, those which are KPI's for the Bulgarian economy. The latter indicators are designed to be measurable and relevant to the impacts of major transport investments.

Proposals for Outcome Monitoring are contained in **Table 10.11.**

Table 10.11 - Outcome Monitoring

Type of Intervention	New Infrastructure	Maintenance and Rehabilitation	Network Strategies	Control & Information Systems	Management / Institutional Systems	Education & Training	Further Strategy Plans
Outcome Monitoring	✔	✔	✔	✔	✔	✔	
Key Performance Indicators: Transport System							
Time savings veh hrs	✔	✔					
Time saving per vehicle journey	✔	✔					
Time savings pass hrs	✔	✔					
Time saving per passenger journey	✔	✔					
Pass kms change	✔	✔					
Veh kms change	✔	✔					
% change in mode choice (passengers)	✔	✔					
% change in mode choice (freight)	✔	✔					
Customer Satisfaction				✔			
Economic Indicators							
Additional Regional / National GDP*	✔	✔		✔			
Additional Employment – Temporary*	✔	✔		✔			
Additional Employment – Permanent*	✔	✔		✔			

* Transport will be only one of many factors that influence GDP and non-direct employment

10.5.6.5 Cost Benefit Analysis

Both Economic Cost-Benefit Analysis (CBA) and Financial Analysis aim to assess the value for money of projects. They examine the project from different viewpoints and contain differing costs and benefits. Financial analysis considers the financial impacts on the owner of the project. Economic cost-benefit analysis assesses the value of the project from the viewpoint of Society as a whole, regardless of to whom the benefits and costs fall. An economic cost-benefit analysis assigns a value to certain goods, such as travellers' time and vehicle emissions, for which there is no direct market, whereas the financial analysis considers the transactions that affect the financial flows for the project owner.

The principles and process for cost benefit analysis of GTMP projects has been covered in Section 7.3.

10.5.6.6 Sustainability Scorecard

The concept of Sustainability Scorecards is widely accepted by business and governments. The use of these scorecards reflects the fact that conventional monitoring practices do not fully reflect the growing importance of climate change and environmental degradation, the consumption of energy from non-renewable sources, and the legacy left to future generations. It is anticipated that the scorecard will develop as the monitoring system becomes better established.

Since 1990, Bulgaria's overall performance in key areas of sustainability is relatively good. A review of how total emissions by country have changed between 1990 and 2007 shows that Bulgaria has reduced emissions by approximately 40%, one of the best performances in Europe.

However, Bulgaria's recent performance is less good. Between 2006 and 2007 total emissions increased by 5%, one of the worst performances across Europe. The conclusion must be drawn that the large improvements in earlier years was due to a once-for-all re-structuring and closure of many large industrial plants with high levels of polluting emissions, and that as the economy has recovered and grown, so have emissions.

The position with regard to transport is different, whereas there was a large decrease in emissions from 1990 to 2007, there was also a small decrease between 2006 and 2007. The explanation for the large decrease from 1990 probably lies in the introduction of more efficient vehicles. The decrease in emissions between 2006 and 2007 is encouraging, and the Master Plan should ensure this improvement is maintained.

The issues covered in the Sustainability Scorecard would emerge from the comprehensive economic and environmental evaluations. However, the environmental evaluation particularly covers many other aspects, some at a micro level, and the cost benefit analysis monetises outputs and expresses the value of the project in a single monetary value, so that the bigger picture with respect to sustainability is lost.

The role of the Scorecard is to highlight certain outputs of the environmental evaluation at a macro level which contribute specifically to mitigation of climate change and the development of a safe, healthy environment.

Table 10.12 gives recommendations for the scorecard. Each attribute is given a measure so that the conclusion and score is related to a quantitative basis. Importantly, the measurements must be made within the project's geographical area of influence in order to limit the influence of "confounding factors". Secondly, scores and weights are suggested for each attribute. These are suggested in order to initiate discussion; what these scores and weights are is ultimately a matter for the Ministry of Transport, Information Technology and Communications to decide.

Table 10.12 - Master Plan Sustainability Scorecard

Attribute	Measurement (within the project's area of influence)	Score	Weight
1. **Fuel efficiency**			
(a) Passenger transport	Litres of fuel consumed per pass km, and per inhabitant	>10% reduction (increase): 5 (-5) 5-10% reduction (increase): 4 (-4) 0-5% reduction (increase): 3 (-3)	10
(b) Freight transport	Litres of fuel consumed per tonne km, and per inhabitant	>10% reduction (increase): 5 (-5) 5-10% reduction (increase): 4 (-4) 0-5% reduction (increase): 3 (-3)	10
2. **Greenhouse gas emissions**	Tonnes of CO_2 produced by transport activity per day, and per inhabitant	>10% reduction (increase): 5 (-5) 5-10% reduction (increase): 4 (-5) 0-5% reduction (increase): 3 (-4)	5
3. **Journey Lengths**	Average trip length per journey	>5% reduction (increase): 5 (-5) 0-5% reduction (increase): 4 (-4)	5
4. **Air quality**	% NO_x adjacent to population centres	>15% reduction (increase) 5 (-5) 10-15% reduction (increase) 4 (-5) 0-10% reduction (increase) 3 (-5)	5

Attribute	Measurement (within the project's area of influence)	Score	Weight
5. **Mode shift**			
(a) Passenger	% reduction by road	10% reduction (increase): 5 (-5) 5-10% reduction (increase): 4 (-4) 0-5% reduction (increase): 3 (-3)	5
(b) Freight	% tonne kms lifted by road	10% reduction (increase): 5 (-5) 5-10% reduction (increase): 4 (-4) 0-5% reduction (increase): 3 (-3)	5
6. **Safety**			
(a) adults	% reduction in road accident fatalities and seriously injured, adults	15% reduction (increase) 5 (-5) 10-15% reduction (increase) 4 (-5) 0-10% reduction (increase) 3 (-5)	10
(b) children	% reduction in road accident fatalities and seriously injured, children	15% reduction (increase) 5 (-5) 10-15% reduction (increase) 4 (-5) 0-10% reduction (increase) 3 (-5)	10

The Scorecard incorporates a number of the most important environmental indicators and measures (fuel efficiency, air quality and emissions) in the context of sustainability. The monitoring for other particular and more detailed environmental issues are incorporated in to the Strategic Environmental Assessment as summarised in section 9.8.

10.5.7 *Monitoring Database*

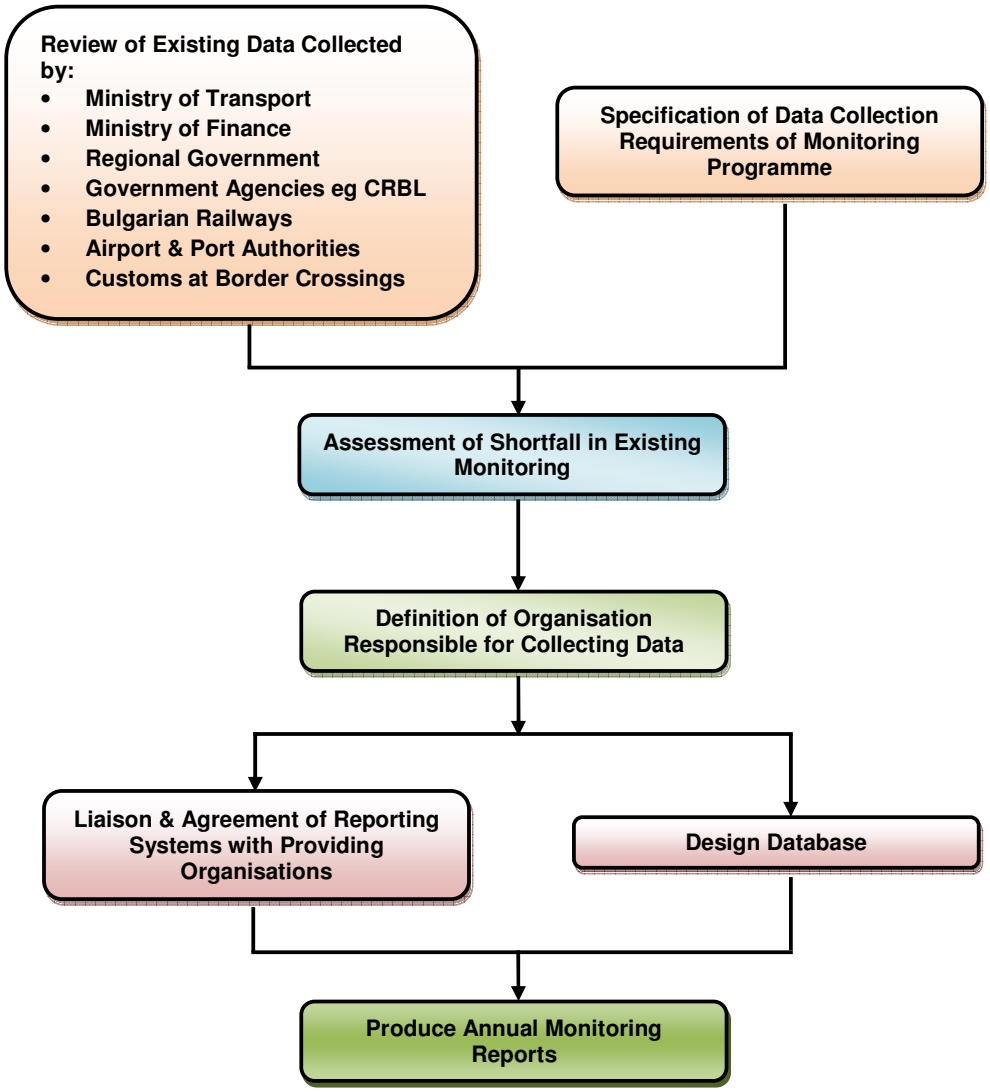
There are existing database arrangements for monitoring within the OPT via the Unified Management Information System (UMIS), which the Ministry of Transport, Information Technology and Communications will use for the efficient management and control of OPT and for preparing formal reports on the funds management as required by the European Commission.

The UMIS database will primarily monitor the financial and physical aspects of the programme, with less (if at all) on the outputs, outcomes, cost-benefit analysis and sustainability aspects. Many of the outputs and outcomes should be part of the national system for transport data collection, and many are already part of the Eurostat database requirements.

It is therefore recommended that existing arrangements for gathering and recording transport statistics are developed further, as a matter of priority. The management of this transport database should reside in the Ministry of Transport, Information Technology and Communications.

In order to set up an effective monitoring system as proposed in this Report, certain actions will be required to be implemented immediately. These are shown schematically in **Figure 10.1.**

Figure 10.1 - Processes Required to Set Up Monitoring Database



10.5.8 *Institutional Issues and Key Recommendations*

The Managing Authority of the OPT has formed a separate unit within the "Monitoring" department, which is to exercise the functions of a national OPT evaluation unit and be responsible for the coordination, organisation and conduct of OPT evaluations.

The unit's functions include the following:

- Drawing up and implementation of an indicative plan for on-going evaluation of the OPT in line with the principles, approaches, methods and recommendations set out in Working Document No.2 and Working Document No.5 of the European Commission;
- Determining the scope, objectives and frequency of ongoing evaluations of the OPT;
- Drawing up a schedule and action plan for carrying out on-going evaluations;
- Preparing technical terms of reference for conducting tender procedures for carrying out on-going evaluations of the OPT by independent evaluators;
- Conducting tender procedures for selecting contractors for on-going and thematic evaluations of the programme;
- Approval and acceptance of the work carried out by independent evaluators of the programme;

- Preparing and dissemination of information on the independent on-going and thematic evaluations of the OPT, and informing the Managing Committee of the OPT and the European Commission of their results;
- Ensuring linkage between the monitoring and evaluation responsibilities;
- Interpreting data on the OPT monitoring indicators and information received from programme beneficiaries;
- Coordination and cooperation in collecting statistical data on the evaluations;
- Analysis of the recommendations made by external evaluators and by the European Commission; and
- Monitoring the external evaluators' activities.

The funding of these OPT evaluations will be through "Technical Assistance" Priority Axis V for organising and carrying out evaluations, data collection, making examinations and analyses. Although there is obvious synergy between the OPT monitoring and Master Plan monitoring, the above arrangements mean that the wider evaluation of the National Transport Master Plan will not be fully covered by the OPT monitoring and the funds provided for it.

The data collection aspects of the monitoring should be a core function of the Ministry of Transport, Information Technology and Communications, and the transport data should be used to inform the Ministry's and the Government's policies and expenditures. Therefore, it is recommended that the data collection aspects of the Master Plan monitoring process are fully integrated within the Ministry's existing systems, and managed, and funded, by the Ministry (this does not preclude EU funding to assist with designing and setting up such a system).

Four Key Recommendations arising from the proposals for a monitoring and evaluation strategy are proposed:

- **That the Ministry of Transport, Information Technology and Communications sets up a Transport Statistics Unit to collate and collect the transport system data necessary to monitor the Master Plan.**

- **Pre-implementation monitoring, that is measuring the outputs and outcomes for the Master Plan priority projects must be commenced immediately in order to make any sense of the monitoring results during and after project implementation.**

- **The "Areas of Influence" for the Master Plan Priority projects must be defined as soon as possible in order to define the limits of pre-implementation monitoring.**

- **That the Ministry of Transport, Information Technology and Communications immediately reviews the transport statistics and monitoring data that is currently collected, and institutes a process for collecting the additional data required.**

Appendix A- Schedule of Key Reports

Schedule of Project Key Reports

Report Number	Report Title	Stage Number (Contract)	Activity Number (Technical Spec)
KR1	Transport Model Development Report	I	10
KR2	Analysis of Existing Transport System and Weaknesses to be Overcome	I	1
KR3	Analysis of Future Transport Demand and Future Weaknesses to be Overcome	I	2
KR4	Option Identification Report	II	3
KR5	Appraisal Framework Report	II	4
KR6	Initial Assessment Report	II	5
KR7	Detailed Assessment Report	II	5
KR8	Transport Master Plan Report	III	6
KR9	Environmental Assessment of the General Transport Master Plan	III	6
KR10	Asset Maintenance Strategy Report	III	7
KR11	Implementation and Funding Strategy	III	8
KR12	Monitoring and Evaluation Strategy	III	9
KR13	Human Resource Development Strategy	III	9
FR	Final Report	IV	-

Appendix B - Development of Transport Models

Appendix B - Development of Transport Models

B.1 Introduction

As part of the study, AECOM has developed a large-scale multi-modal transport model of Bulgaria. This model has been used to inform the design of transport schemes by providing a clear picture of the current status of transport demand and supply within Bulgaria.

It has also been used to test the impact of proposed transport schemes and assess the value for money that each proposal offers, and to project the impact of such schemes into the future to assess their future sustainability. The models have been designed to meet the specific requirements set down in the technical specification.

This appendix provides a summary of the construction and workings of the transport model (from here onwards referred to as the Bulgaria Transport Model, or BTM).

B.2 Model Structure

The BTM covers passenger and freight transport and different transport modes:

- Road (Car and motorcycle)
- Road (Truck)
- Road (Bus)
- Rail
- Air
- Maritime and inland waterway

The models also cover:

- Journeys wholly within Bulgaria;
- International journeys with their origin or destination in Bulgaria; and
- Transit trips.

All types of trip are assessed in the models taking account of economic and demographic changes and changes in the competitiveness of each transport mode. The models contain clear and logical linkages between economic/demographic change and overall transport demand. The models are designed to be able to simulate the following impacts:

- Choice of destination (or entry/exit points for international trips);
- Choice of transport mode;
- Broad route corridor;
- Change in infrastructure provision;
- Changes in public transport services; and
- A range of policy scenarios relating to factors such as pricing for use of highways or public transport, and taxation changes.

The models also contain mechanisms for allowing trips to be suppressed if travel conditions worsen and for additional trips to be induced when conditions improve.

Modelling has been undertaken for 2008, 2015 and 2030. The base 2008 model has been validated so that it re-produces existing demand to an appropriate level of accuracy.

Where a particular mechanism has the potential to simulate a behavioural response to changes in the transport system this is based on robust research applicable to current and expected future conditions in Bulgaria.

The BTM is a large-scale inter-urban model comprising both elements of people movement and also the movement of freight. It is required to be able to test the impact of relatively large-scale improvements to the infrastructure available for relatively long-distance inter-urban travel between Bulgarian cities and between Bulgaria and the rest of Europe. It is not required to represent in detail travel within towns and

cities, but it is required to estimate and model transport in the rural areas of Bulgaria and the movement of international travellers into and out of Bulgaria by all modes.

The model is required to provide analysts with a sound estimate of patterns of existing demand and infrastructure (the Base Year case), to forecast likely changes in patterns of demand over time, and to predict the impact of and benefits associated with any proposed transport schemes.

B.3 Model Approach Adopted

We have adopted the following overall modelling approach in support of the development of the Bulgaria General Transport Master Plan:

- We undertook a large-scale data collection exercise, including new surveys as well as collecting published information, all of which have formed the basis of a sound technical dataset;
- We have developed a large-scale multi-modal modelling package, the Bulgaria Transport Model (BTM), which covers two main modelling elements, the Bulgaria Passenger Transport Model (BPTM) and the Bulgaria Freight Transport Model (BFTM);
- Based on the extensive data collected, we developed a large-scale multi-modal passenger transport model using EMME, a state-of-the-art transport planning software package.
- The model covers passenger journeys (car, rail, coach and ferry) wholly within Bulgaria, international journeys with their origin or destination in Bulgaria, and transit trips. This is complemented by separate spreadsheet-based models for the analysis and forecasting of air and maritime passenger travel;
- A spreadsheet-based model has been developed for the modelling of freight movements by different transport modes (road, rail, water and air), for both domestic and international goods movements (Imports, Exports and Transit);
- The model has a validated 2008 based year model, and forecasting year models for 2015 and 2030;
- The model enables the assessment of transport demand and network supply taking into account economic and demographic changes, and logical linkages between economic/demographic change and overall transport demand; and
- The model allows for the full assessment of changes in infrastructure provision, changes in public transport services, and a range of policy scenarios to inform the development of the Bulgaria General Transport Master Plan.

New data collection has been necessary due to a lack of significant existing data sources for Bulgaria. Surveys have been conducted across the country to determine patterns of travel by private vehicle, rail and coach, interviewing travellers and counting people and vehicles.

The complete model has been constructed on the basis of these data, and has the following principal components:

- A representation of transport supply, that is, a specification of what transport is available to prospective travellers. This includes a full depiction of the road network, including capacity, road quality and distances; as well as public transport networks and timetables; and
- A representation of transport demand, that is, a specification of how many people want to travel, where they want to travel from, and where they want to travel to. In addition, this includes an estimate of why people are travelling (to their place of work, on business, for leisure, etc.), because this is helpful in determining their likely decisions, and includes other aspects of information about travellers, such as whether they have access to a car or not.

In addition, the model needs to be capable of forecasting the effect on transport infrastructure and travellers of any new scheme, and to forecast the behaviour of transport in the future, and thus requires the capability to predict how travellers make decisions about their trips. This is done in two stages:

- Mode Specific Assignment Models, which determine the routes travellers take to get from their origin to their destination; and
- Behavioural Models, which determines how travellers choose between different attributes of their journey, including what mode to use (car, bus, rail etc.), and where to travel to, based on the available transport infrastructure.

Finally, processes are required to forecast the impact of external (socio economic and demographic) factors that influence the development of travel demand over time, including:

- A Growth Model, which forecasts likely changes to patterns of and level of demand over time, based on changes in the economy, population and land-use, to provide initial estimates of future-year demand; and
- A Car Availability Model, which forecasts changes in car-ownership over time, also to provide initial estimates of future-year demand.

It should be noted that rail freight, air freight and waterborne freight are dealt with separately through individual spreadsheet models.

The Bulgaria Freight Transport Model (BFTM) has been created for the representation of movements of materials by different transport modes (road, rail, water and air), and covers both domestic and international freight demand, with the latter further split into Imports, Exports and Transit movements.

Finally the passenger model (BPTM) and freight model (BFTM) are inter-linked in that:

- Both models share a common technical database established as part of the study;
- Base year heavy goods vehicle (HGV) trip matrix and travel cost data derived from the highway model are used as input to the base year Freight Transport model; and
- The future year growths of heavy goods vehicle (HGV) demand estimated from the future year freight model will be used as input to the passenger transport model, so that the impacts of HGV volumes on highway journey times, and routing choices are reflected in the assignment.

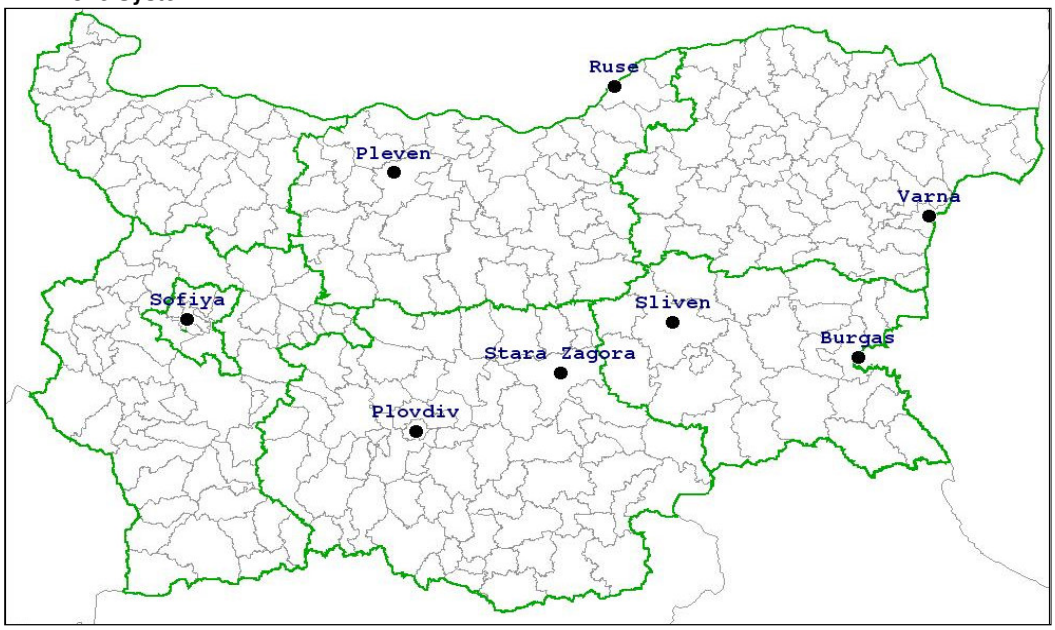
B.4 BPTM Scope and Structure

B.4.1 Model Scope

B.4.1.1 Study Zoning

The creation of a transport model necessitates a decision regarding how finely to represent transport demand spatially. Our object was to obtain information about inter-urban long-distance patterns of demand, and, as such, it is appropriate to divide the ends (origin and destination) of a traveller's trips by zones, which may contain many small towns.

BTM Zone System



For the most part, this simply represents every municipality as a single zone. In addition, the city of Sofia has been divided into nine smaller zones.

International trips are allocated on the basis of individual countries: for example, Serbia is a single zone.

The total number of zones in the model is 314.

Number of Zones Summary

Region	Number of Zones
Sofia	9
Rest of South-West	51
North-West	32
South-Central	68
North-Central	41
South-East	22
North-East	49
Total Number of Domestic Zones	**272**
International	42
Total Number of International Zones	**42**
Total Number of Model Zones	**314**

B.4.1.2 Modes

The BPTM represents three different modes:

- Private highway vehicles, including freight traffic as well as all car travel.
- Inter-urban coaches.
- Rail.

No representation is included of air travel; this is because there are only two permanent public service air routes within Bulgaria (Sofia-Varna and Sofia-Burgas) and because their share of demand is very small. Because the proportion of travel is small, air demand would be poorly represented by a mode choice model, and hence a more accurate assessment is achieved by considering the air market independently from other modes and externally to the main transport model.

Trams, taxis and urban bus services are not included as they are too short-distance to be within scope for the model.

B.4.1.3 Time Periods

The BPTM contains a representation of a single time period: the twelve-hours between 07.00 and 19.00 on an average weekday. Research into Bulgarian traffic data has revealed that on an average weekday, 72% of the total traffic is present between the hours of 07:00 and 19:00. This is based on 2005 traffic counts carried out at over 117 sites across Bulgaria.

It should be noted that although the model is constructed to forecast 12 hour weekday demand, the actual option assessment considered all traffic throughout the year, through the use of annualisation factors. The model estimate of traffic levels can be converted to day, monthly or yearly if required, using appropriate factors.

B.4.1.4 Journey Purposes

Travellers were divided into six segments, by purpose and car availability, within the BPTM:

- Commuting, with a car available;
- Business, with a car available;
- Leisure, with a car available;
- Commuting, with no car available;
- Business, with no car available; and
- Leisure, with no car available.

B.4.1.5 Freight

Heavy goods vehicle (HGV) traffic volumes are modelled as part of the highway model. This allows the impact of congestion, or infrastructure changes, on freight costs to be identified. However changes in mode of travel or the distribution of trips are not assessed within BPTM. Interventions are considered externally to assess changes in these factors.

As noted previously rail freight, air freight and waterborne freight are dealt with separately through the individual spreadsheet models.

B.4.1.6 International Travel

International travellers are included within the BPTM. However, like freight they are not subject to mode-choice or redistribution within the BPTM, because the model alone, being focussed on Bulgaria, is unable to fully represent all relevant international factors. Interventions are again considered externally.

International freight movements (imports, exports, and transit) and air passenger travel are dealt with separately through the individual spreadsheet models.

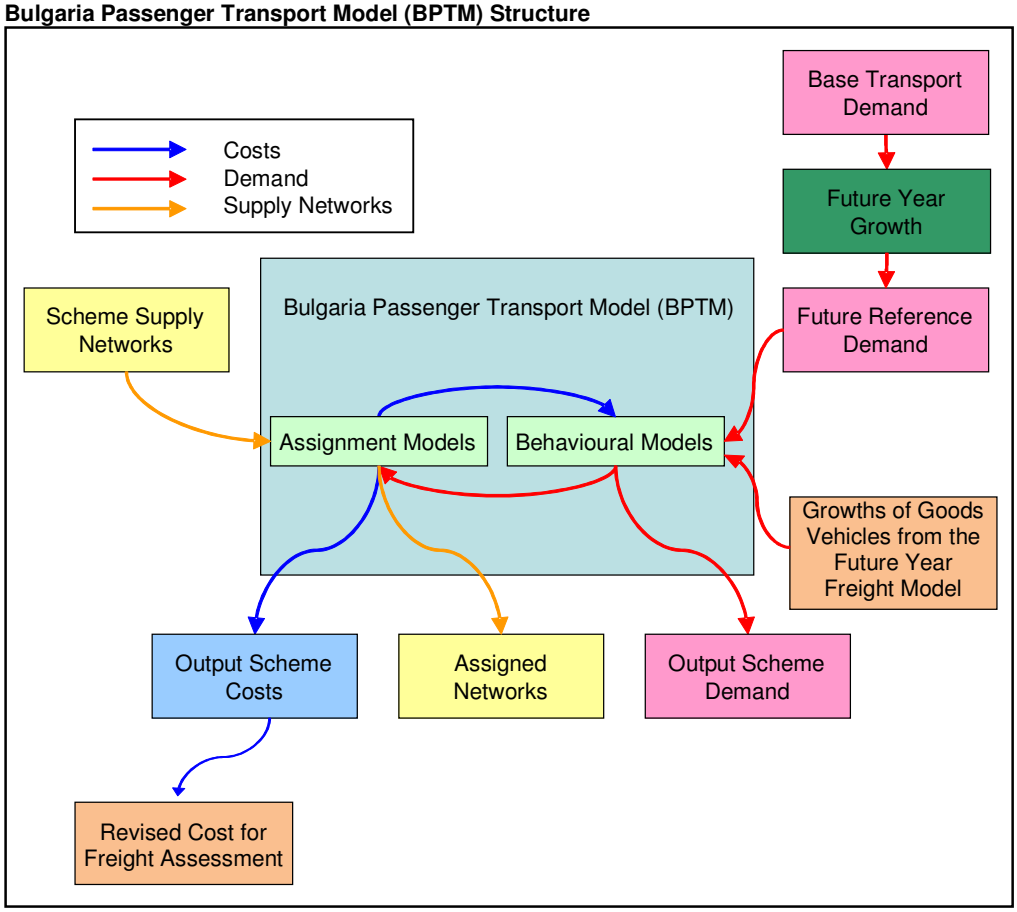
B.4.1.7 Water Mode

Inland waterway passenger transport crossing the River Danube is represented within the strategic model. Maritime passenger travel is not included in the strategic model, due to an insignificant level of demand currently being observed.

B.4.2 *Model Structure*

The overall structure of the model is illustrated below.

Bulgaria Passenger Transport Model (BPTM) Structure



Base Transport Demand is derived from observed data. This generates "reference demand", which is an indication of the predicted level of demand for transport in the future in the absence of any changes to the transport infrastructure other than those under construction or for which there is an irrevocable commitment. The reference demand is fed into the BPTM, along with a representation of the transport infrastructure scenario that is to be tested. The assignment and behavioural models iterate, passing transport costs and transport demand back and forth until a stable solution is found, at which point the model terminates.

The iteration is required for the following reason:

- The assignment models take as an input traveller demand (as well as a representation of the supply networks). They assign these travellers to routes, and produce costs ("costs" means both monetary costs and the time taken to get from their origin to their destination) for all travellers;
- The behavioural models take as an input transport costs (as well as reference demand). They compare the costs with those in the base model, and derive expected changes in demand because of those cost changes (e.g. if a new motorway is built, more people will travel by road).

Therefore the assignment models derive costs as a function of demand, and the behavioural models derive demand as a function of costs, and so iteration to reach a stable solution is required.

The outputs of the model are threefold:

- Demand levels, by origin, destination, mode and purpose.
- Assigned networks, containing traffic volumes on roads, passenger occupancies of public transport vehicles, and other network information.
- Costs of travel by origin, destination, mode and purpose, including monetary costs and travel times.

The outputs are used to inform appraisal in terms of:

- operational performance of interventions (reflecting the balance between demand and capacity available);
- economic and financial performance (derived from demand and travel costs); and
- environmental performance (reflecting in particular vehicle kilometres from the network outputs).

B.5 Data

B.5.1 Sources of Data

Data used in the construction of the BPTM can be divided into three groups:

- Surveys commissioned by AECOM specifically for the BPTM to assess current levels of demand for transport;
- Focus groups commissioned by AECOM specifically for the BPTM to assess people's perceptions of travel and the Bulgarian transport system; and
- Other sources of data, not commissioned specifically for the BPTM, but to which AECOM have access and which have been used in the development of the model.

B.5.2 Demand Surveys

The construction of a transport model requires a thorough understanding of the current situation. Some of this has been possible to acquire from existing data, but comprehensive estimation of current transport demand required new surveys:

- Roadside interviews and traffic counts at 41 sites on main roads around Bulgaria, as well as traffic counts alone at a further 26 sites. These included all major border-crossings;
- Passenger interviews and boarding and alighting counts at six key coach stations; and
- Passenger interviews and boarding and alighting counts at six key rail stations.

All surveys were conducted from 07.00 to 19.00 to accord with the time period used by the model.

B.5.2.1 Roadside Interviews and Counts

A roadside interview (RSI) is a short interview carried out by surveyors with drivers at the road-side. It aims to determine key information about the trip that the driver is currently making.

The surveys took place outside the summer season to reflect the level of demand that represents a typical season in Bulgaria.

Site locations were carefully selected so as to intercept all strategic inter-urban trips within Bulgaria and all significant movements into and out of the country. The sites form a series of screen lines and cordons ensuring full observation of trips between different sectors of the country.

At some sites, only manual classified counts (MCCs) we undertaken. MCCs were also conducted at every RSI site. MCCs count vehicles passing through the site in both directions by vehicle type (car, lorry, motorbike etc.).

The questionnaires were designed to obtain essential basic information from drivers in relation to the trips that they were making. The pertinent information collected was as follows:

- Vehicle type;
- Number of occupants in vehicle;
- Purpose of travel;
- Where the vehicle was coming from (origin & border crossing if applicable); and
- Where the vehicle was going to (destination & border crossing if applicable).

Drivers of both cars and trucks were interviewed. The truck driver's questionnaire was more detailed asking for information on the load being transported.

In all, around 30,000 vehicle interviews were carried out.

B.5.2.2 Passenger interviews and counts at coach and rail stations

The public transport surveys were conducted over the course of several days at twelve key rail and coach stations in Bulgaria, as shown below.

Rail and Coach Survey Sites

Rail Station	Coach Station
Sofia	Sofia
Plovdiv	Plovdiv
Burgas	Burgas
Varna	Varna
Gorna Oryahovitsa	Ruse
Stara Zagora	Haskovo

The surveys targeted passengers waiting in the station departure halls, boarding trains and coaches or waiting on the station concourse.

The interviews provided the following key pieces of information:

- Travel purpose (business, leisure, commuting);
- Number of people in group;
- Car availability (could the traveller have used a car for the journey);
- Where the traveller was coming from (origin & border crossing if applicable); and
- Where the traveller was going to (destination & border crossing if applicable).

About 2,700 coach passenger interviews and around 2,300 rail passenger interviews were carried out.

B.5.3 *Focus Groups and Stated Preference Analysis*

Transport market research was undertaken through focus groups with members of the travelling public in Sofia, Plovdiv and Varna. Their object was to provide a greater understanding of people's perspectives of the choice, service, costs and quality of inter-urban travel between major cities. This included discussion of the following specific aspects of travel:

- Benefits and costs of travel by car, coach, train and plane;
- Affordability of cars and fuel;
- Desirability of owning a car;
- Where the discussion group members travel to and why;
- Whether there are any barriers in place to more frequent travel and what they are;
- Improvements that discussion group members would like to see in the transport system; and
- Which aspects of travel cost (journey times, comfort, reliability, service frequency, safety, fares and fuel prices) members consider most important.

The results of these surveys were used to inform our understanding of the strengths and weaknesses in the current transport systems.

Stated preference surveys were also conducted. These were designed to identify the likely response of travellers to various improvements to the transport system by asking respondents to select one of a number of alternative journeys as the one that seemed best to them, in a number of different scenarios. These surveys were of value in enabling the derivation of 'willingness to pay' or 'value of time' factors appropriate to Bulgaria, which is important since these are likely to be significantly different from the values appropriate to other European countries.

B.5.3.1 *Journey Time Surveys*

Journey time surveys were carried out to assist with the derivation of speed flow curves and network validation.

The surveys were carried out along key routes in Bulgaria linking major towns and cities. The surveys covered 2,661Km in total.

The journey times collected were based on a car travelling at the same speed as the general traffic flow for that given day. The journey times were compared with other observed data sources such as the "Michelin Journey Time Database" to ensure consistency when using journey time information to calibrate and validate the model.

B.5.3.2 *Other Sources of Data*

Data from a large number of other sources was also collected. The list below is a summary:

- Ticket sales data from the rail operating company BDZ for the month of March 2008;
- Rail timetables from the BDZ website;
- Coach timetables from the avtogari.info website;
- Global transport statistics from the 2006 Bulgaria National Statistics Institute annual yearbook;
- Road and rail network topologies from MapInfo layers acquired from the GIS Company; "GfK GeoMarketing";
- Public transport fare information collected from the BDZ website and the websites of a number of coach operators;
- Populations by municipality from the Republic of Bulgaria Administrative Atlas; and
- Values of time from Ministry of Transport guidance.

B.6 Passenger Trip Matrix Development

B.6.1 *Car and Truck Trip Matrix Development*

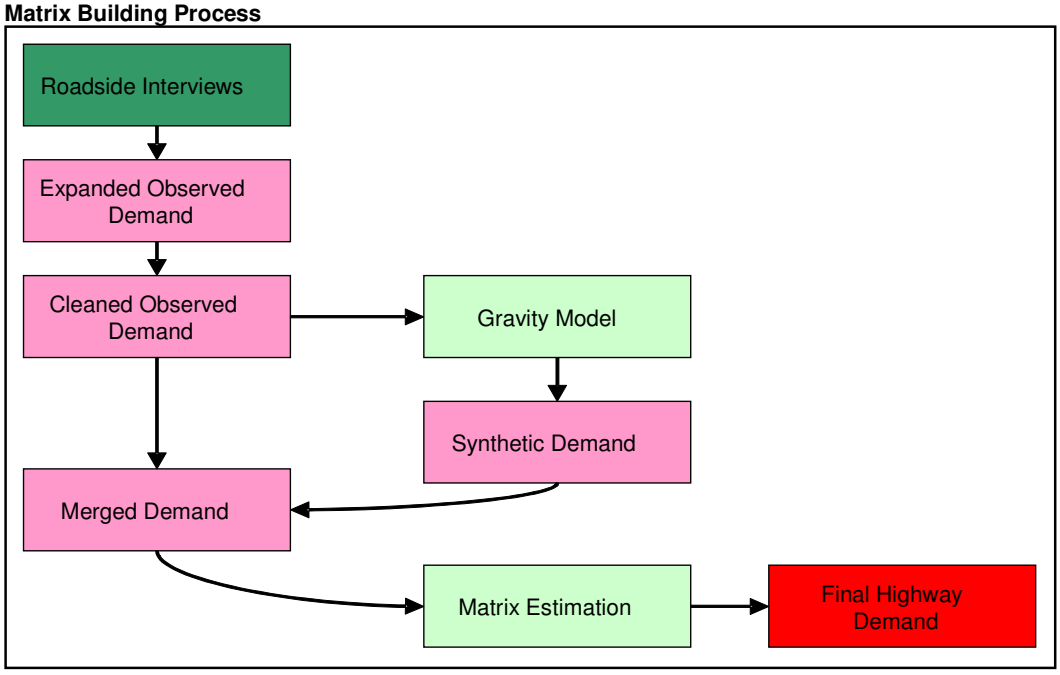
B.6.1.1 Requirements

Trip matrices for highway travel for the BPTM are intended to represent all inter-urban ground travel by personal vehicle, as well as all road-based freight travel that passes through Bulgaria for at least part of its journey. These include journeys wholly within Bulgaria, international journeys with their origin or destination in Bulgaria (including trips using ferries crossing the River Danube), and transit trips. Trips wholly external to Bulgaria which do not pass through Bulgaria for any part of the journey (e.g. Romania to Russia) are not included.

Separate matrices were constructed for each traveller purpose. Four highway trip matrices were built for the Bulgaria Transport model, these representing Business, Commuting and Leisure car travellers and Freight traffic.

The overall process is summarised below.

Matrix Building Process



B.6.1.2 Roadside Interview Data

The first stage of matrix-building was to analyse the roadside interview data and to construct an "observed matrix" containing trips solely for those travellers actually interviewed.

Each interviewee was asked for their origin and destination (which during data analysis were converted to the model zones) and the purpose of their trip. Through an automatic process this allowed the conversion of the 30,000 interview records into trip matrices by purpose. Any interview record that did not pass range and logic checks was excluded from the matrix building.

B.6.1.3 Expansion, Transposition and Removal of Multiple Observations

The interview records alone represent only a sample of the total traffic. At every site at which interviews were performed a count of traffic was also made, so making it possible to expand the interview records up to the count data totals. For example, if 500 interviews were undertaken, and 1500 vehicles were counted travelling in the interview direction, we assume that the interviews represent a good random sample of traffic at that site, and multiply the observed records by three to represent total travel through the site.

A similar assumption can be made about vehicles travelling in the opposite direction from that surveyed (at each site, interviews were carried out for traffic moving in one direction only). Given that any outgoing trip is almost certain to eventually return to its starting point (excluding moving-house and other rare events), we can assume that, at an all-day level, the traffic characteristics in each direction on a road will be the same. Therefore the interview records are transposed (that is, the origins and destinations are switched), and the result expanded by the traffic counts in the reverse direction, to estimate reverse direction travel.

Because interviews were undertaken at many locations across Bulgaria some journeys were intercepted more than once. For example a trip from Sofia to Burgas will have passed through four interview sites and will have been surveyed four times (once for each site passed). Therefore, the level of demand for all origin-destination pairs was divided by the number of interview sites passed.

The resulting matrix is known as the "Expanded Observed Matrix".

B.6.1.4 Synthetic Demand

Since the observed trip data does not include all trips, there is a need to develop a process to in-fill these missing trips. To this end, a synthetic gravity-type model was developed, primarily in order to estimate unobserved demand.

The gravity model was used to calculate estimated demand for every origin-destination pair, based upon the cost of travel between the two zones and the population of each zone. The expression from which demand was derived was as follows:

$$D_{ij} = k \times P_i^{\alpha} \times A_j^{\beta} \times \exp(\lambda \times C_{ij}) \times C_{ij}^{\mu}$$

where

D_{ij} is the demand from origin zone i to destination zone j

P_i is the population of origin zone i

A_j is the population of destination zone j.

C_{ij} is the generalised cost of travel by car from origin zone i to destination zone j, as measured by our network model. It includes a component of both actual travel time and an estimate of the cost of fuel for the journey.

$k\ \lambda\ \alpha\ \beta\ \mu$ where parameters determined separately for each traveller purpose (Business, Commuting, Leisure and Freight)

The calibrated parameters for deriving synthetic highway trip matrices are summarised below.

Calibrated Parameters for Deriving Synthetic Highway Trip Matrices

Fitted Parameter	Car			HGV	LGV
	Commuting	Business	Other		
k	3.207E-07	3.063E-07	1.645E-07	2.127E-09	3.640E-09
α	1.000	1.000	1.000	0.950	0.915
β	1.140	1.140	1.139	1.106	1.078
λ	-0.038	-0.017	-0.013	-0.034	-0.038
μ	-0.984	-1.070	-1.083	0.402	0.403

B.6.1.5 Merging Demand

It was then necessary to combine the synthetic demand estimated by the gravity model with the observed demand.

For all unobserved zone pairs, synthetic demand alone was used. For other domestic zone pairs, 2/3 of observed demand was added to 1/3 of synthetic demand to produce a combined estimate of travel. This is based on an approximate estimate of the level of error on each set of data.

For international travel, only the observed matrix was used. The result of this is known as the "Merged Matrix"

B.6.1.6 Matrix Estimation

To better reflect all the data that was available, including both sets of roadside counts (MCC commissioned for this project and AADT counts obtained for validation) as well as the population and cost data, "matrix estimation" was undertaken.

This involved repeatedly selecting links in the model, determining which zone pair movements use the links and adjusting demand for those zone pairs in order to make the traffic volumes on those links closer to the MCC counts.

It is important when adjusting the matrices in this way to ensure that the process does not distort the trip-length distribution to a significant degree. Accordingly, this was inspected before and after applying matrix estimation and the difference noted. This comparison showed that the matrix estimation process had little effect upon the general structure of the matrices.

The resulting matrices produced by the matrix estimation process were the final base year highway matrices used by the model.

B.6.1.7 Summary

The final highway demand matrices are summarised below. HGV (heavy goods vehicles) refers to freight transport. LGV (light goods vehicles) refers to light vans, treated throughout most of the model as business travellers.

Vehicle Type	Segment	Person Total	Vehicle Total	Average Person Trip Length (Km)
Car	Commuting	893,464	495,543	10.2
	Business	955,561	533,535	20.5
	Leisure	694,354	300,066	27.8
	All	**2,543,378**	**1,329,144**	**18.9**
Freight	HGV	54,099	54,099	90.1
	LGV	33,604	33,604	57.4
	All	**87,703**	**87,703**	**77.6**

B.6.2 Bus Trip Matrix Development

B.6.2.1 Requirements

Trip matrices for coach travel in Bulgaria are intended to represent all long-distance coach-travel, and be a reasonable reflection of inter-urban medium-distance bus travel. They are *not* intended to include intra-urban bus passengers.

Separate matrices were constructed for each traveller purpose and for each car-availability:

- Business (Car Available);
- Commuting (Car Available);
- Leisure (Car Available);
- Business (No Car Available);
- Commuting (No Car Available); and
- Leisure (No Car Available).

The division by car availability enables the mode choice model to decide whether a trip can switch to using a car if conditions merit it, or whether it is forced to use public transport.

B.6.2.2 Key Assumptions

There is generally a lack of national data regarding bus passengers. Apart from some global totals and statistics in the NSI yearbooks, the only source of bus passenger data was the six interview surveys carried out at Sofia, Plovdiv, Burgas, Varna, Ruse and Haskovo.

This being the case, the passenger totals, passenger kilometre totals and average trip lengths in the NSI yearbook for 2006 were used as guides as to the matrices to be derived.

The final highway matrices were used as the starting point for the bus matrices, on the assumption that the general pattern of travel was likely to be similar. International bus trips were estimated together with domestic, using the same methodology.

B.6.2.3 Survey Data

The interview survey data consisted of counts of boarding and alighting passengers, along with a set of interviews of passengers waiting to board a bus. It was been processed in the same way as the highway data. The questionnaire results were converted to origin-destination pairs and added to an EMME demand. Six demand matrices were created, representing the three purposes and two car-availabilities.

The interview records were multiplied up by passenger boarding counts to better reflect total demand, assuming the interviews to be a reasonable sample of the demand as a whole.

Reverse direction passengers (a transpose of the observed interviews) have been added to the matrix using the *boarding* counts as an indication of the total level of demand.

The above process created an expanded observed matrix, assuming the interview records to be a good reflection of total demand in both directions.

B.6.2.4 Synthetic Demand

Synthetic demand (i.e. not directly derived from observed data) was derived from the highway matrices. However, because the division of bus demand into purposes (Commuting, Business and Leisure), and the average length of a bus trip and distribution of bus trips over distance will inevitably differ significantly from the corresponding distributions of highway trips, we used the interview survey data to re-divide the highway matrices into purposes and to adjust the trip length distribution.

The procedure was as follows:

- the three car highway trip matrices (Commuting, Business and Leisure) were added together to create a single matrix;
- a set of distance-bands: 0-30km, 30-60km, 60-90km, 90-120km, 120-150km, 150-200km, 200-300km and 300km or more, were defined;
- for each distance band, the interview data was used to estimate a proportion of demand to be allocated to each purpose and car-availability, and these proportions used to split the total highway matrix;
- the NSI yearbook value for total coach demand was used to factor the matrices to the correct total; and
- the interview data was used to estimate the proportion of total demand that should be allocated to each distance band, and the matrix adjusted accordingly.

B.6.2.5 Merging Demand

The above process created a synthetic bus demand matrix for combination with the expanded observed matrix. By assigning bus passengers on the model bus network, it was possible to determine which origin-destination pairs pass through one of the six surveyed cities for part of their journey. Clearly origin-destination pairs that do *not* pass through such a location cannot be detected by the interview surveys, and so for such pairs, the synthetic demand alone is used.

B.6.2.6 Summary

The final bus demand matrices are summarised below.

Segment	Trip Total (12 hour weekday)	Average Trip Length (Km)
Commuting CA	21,271	21.6
Business CA	13,685	112.0
Leisure CA	101,642	77.9
Commuting NCA	24,806	10.6
Business NCA	17,700	57.5
Leisure NCA	94,922	60.4
Total Bus Demand	**274,027**	**61.8**

The NSI yearbook quotes around 300,000 passengers for 2006, and coach passenger demand had been falling quite sharply in the preceding years, so we regard this total as appropriate. It should be noted that the average trip lengths here are significantly higher than those for highway trips; this is because short-distance and intra-urban bus travel is *not* included in the BPTM.

B.6.3 Rail Trip Matrix Development

B.6.3.1 Requirements

Trip matrices for rail travel in Bulgaria are intended to represent all rail passenger travel in Bulgaria.

Separate matrices were constructed for each traveller purpose and for each car-availability to be consistent with the coach passenger matrices.

B.6.3.2 Ticket Data

The construction of rail demand matrices was significantly assisted by having access to complete ticket-sales data, giving origin station, destination station and number of passengers, for the month of March 2008. These data were used as the starting point for the construction of the rail demand matrix.

B.6.3.3 Derivation of Twelve Hour Demand

The monthly demand was converted to 12 hours using the following procedure:

- At each of our interview survey sites, the number of departing trains for which passengers were counted during the period 07.00-19.00 was noted, and compared with the total number of timetabled trains from the BDZ website. Generally a proportion of around 20% were omitted from the counts.
- Assuming the average occupancy of a train to be consistent, the total passenger counts at each survey site were factored accordingly, to include trains which were omitted.
- The monthly ticket demand was assigned on the network, and the number of passengers boarding at any of the survey sites was noted. This number was compared to the factored-up survey counts, and the total monthly ticket data factored down accordingly.

The factor derived was 0.02775, i.e. the 12 hour weekday period containing one thirty-sixth of the demand in the entire month. This figure is both logical and plausible.

B.6.3.4 Purpose and Car Availability

The interview survey data was used to divide the ticket data demand by purpose and car availability. The division was done separately by trip lengths (using eight categories of trip length) to account for the bias in favour of longer trips in the interview records themselves.

B.6.3.5 Distribution of true origins and destinations

For domestic trips, true origins and destinations were derived by inspecting the interview records for the distribution of distances travelled to access and egress from the railway stations, and applying this to the ticket data. A proportion of trips which began in the same zone as they boarded a train were derived (60%) and those which were destined for the same zone as they alighted (79%). The remaining trips were distributed to adjacent and nearby zones on the basis of the trip-length distribution of access and egress trips derived from the survey data.

For international trips, actual country of destination has been derived from tourism data from the NSI yearbook, used to split the ticket demand by border crossing.

B.6.3.6 Summary

The final rail demand matrices are summarised below.

Segment	Trip Total (12 hour weekday)	Average Trip Length (Km)
Commuting CA	9,421	21.8
Business CA	954	84.3
Leisure CA	18,530	70.9
Commuting NCA	9,651	27.3
Business NCA	1,858	43.9
Leisure NCA	31,142	99.9
Total Rail Demand	**71,556**	**70.7**

B.6.4 *Inland Waterway and Maritime Trips*

Currently ferry services which carry passengers are provided from Black sea ports Varna and Burgas as follows:

- Varna to Ilichovsk (Ukraine)
- Varna to Ilichovsk (Ukraine) / Poti (Georgia)
- Burgas to Poti (Georgia)

An analysis of the 2007 Bulgaria Border Agency data was undertaken, and the statistics suggest that the 2007 annual total number of cars using the Varna and Burgas ferry services amounted to 155 vehicles and 72 vehicles respectively. Considering a very insignificant level of demand involved, it was decided that car journeys using the Black Sea ports ferry services are not represented in the Bulgaria Transport Model. Instead, separate spreadsheet matrices were developed for ferry passengers.

B.6.5 *Air Passenger Demand*

A spreadsheet-based analysis of airport demand was produced independently of the BTM.

The main source of air passenger demand data for the base year was the Bulgarian Civil Aviation Authority. The estimate of base year air passenger demand was produced by obtaining individual air patronage at each of the study airports. The air passenger demand was estimated and presented as domestic, international and total passenger two-way trips, by airport and countrywide.

Only Sofia, Varna and Burgas airports are considered in the assessment since air passenger demand using other Bulgaria airports is deemed insignificant in the context of the overall travel demand in Bulgaria.

The table below contains the 2008 base year, annual air passengers at the 3 study airports. The annual passenger numbers are split by international and domestic trips.

Airport	Flight Type	2008 Annual Total Passengers
Sofia	International	3,069,500
	Domestic	137,200
	Total	**3,206,700**
Varna	International	1,313,200
	Domestic	119,500
	Total	**1,432,700**
Burgas	International	1,905,500
	Domestic	15,100
	Total	**1,920,600**
Bulgaria Total	International	6,288,300
	Domestic	135,900
	Total	**6,424,200**

B.7 Passenger Transport Network Development

B.7.1 *Highway Network Development*

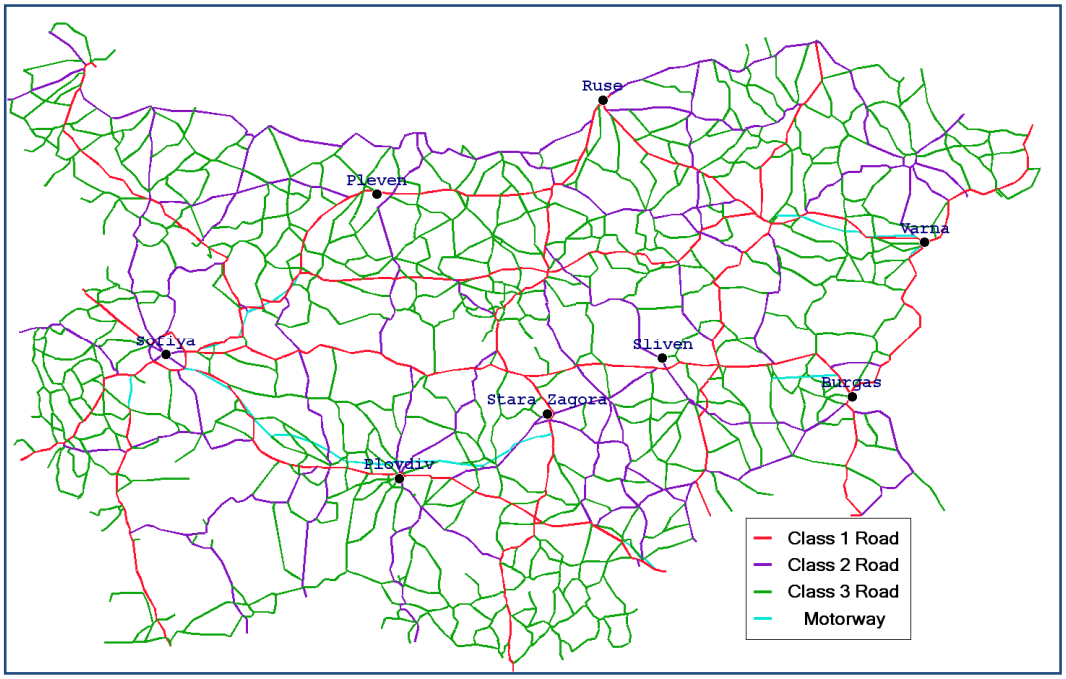
The highway network within EMME was designed to represent the movements of personal motorised vehicles and freight traffic within Bulgaria, and also to provide a framework for coach services to run along.

B.7.1.1 Domestic Network and Road Classification

The primary source of data for the highway network topology and distances was a set of MapInfo layers from the GIS Company; “GfK GeoMarketing”. These MapInfo layers were checked against the road network in the “Administrative Atlas: Republic of Bulgaria, 2007”, published by GLOBAL AGRO Ltd. Any

changes to the highway network since 2007 were incorporated. Global statistics from the National Statistics Institute Yearbook, 2005 were also used as a further check on the coded road network.

The conversion of these layers to EMME format for use in traffic assignment was carried out automatically with the true length, in kilometres, calculated for each link, including all curvature, prior to conversion to EMME. The converted Bulgaria network, in EMME, is shown below.



The road classifications are outlined below. In addition, the total length in km of roads of each class has been calculated, and this compared with a statistic from the NSI Yearbook. It can be seen that these match very closely, except for motorways, the total length of which in Bulgaria has increased significantly in the intervening three years.

Link Classifications

Link Type	Number	Colour	Total Length	Yearbook, 2005	Number of links
Class 1 Road	1	Red	2,946 km	2,969 km	1,231
Class 2 Road	2	Purple	4,063 km	4,012 km	1,563
Class 3 Road	3	Green	11,609 km	11,969 km	4,676
Motorway	10	Pale Blue	442 km	331 km	134
Total Roads	-	**-**	**19,060km**	**19,218km**	**7,604**

The BTM highway network contains 3,246 nodes, and 7,604 links.

B.7.1.2 Domestic Centroid Connectors

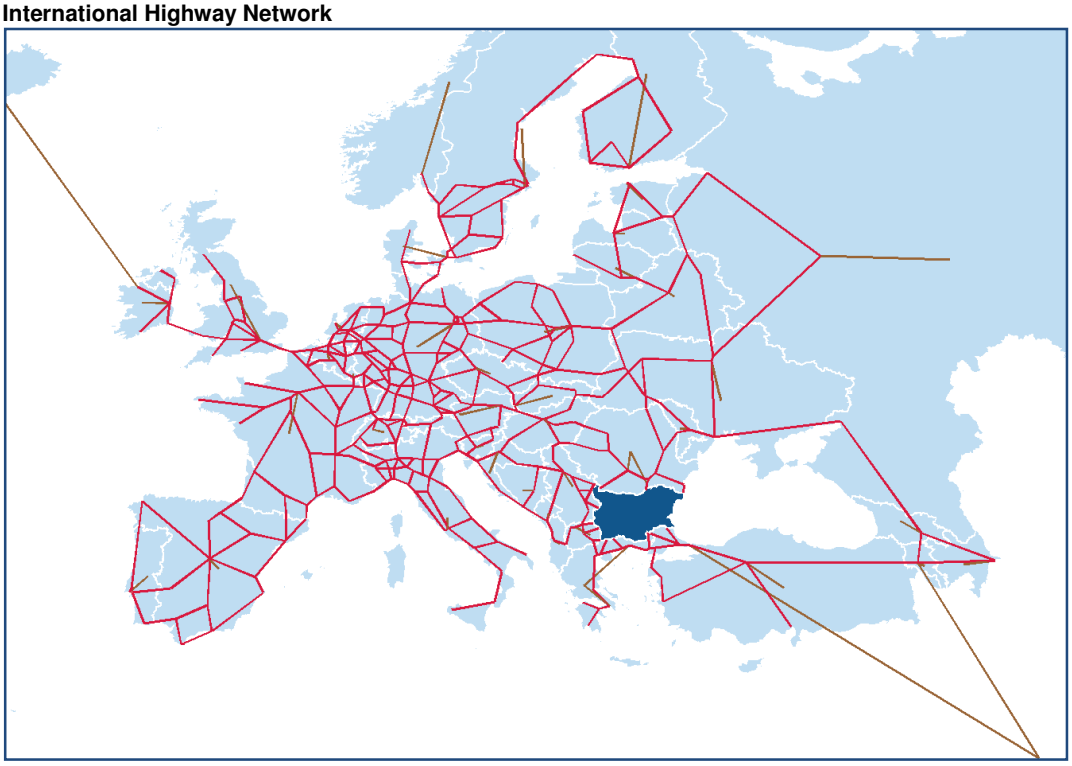
It is necessary to provide a way for transport users to access the highway network, effectively a correspondence between the origin/destination demand matrix and the network. This is achieved by centroid connections, which connect each zone to a point on the highway network.

The general principle in creation of these is to connect each zone to a single point on the network, this point being the largest centre of population in each zone. In a few cases it was considered necessary to add one or more additional connections; this was required particularly where a zone had more than one parallel main road running through it with no connection between the two.

B.7.1.3 International Network

The international network has been coded to allow international traffic to enter Bulgaria at appropriate points. Centroids have been connected to capital cities in the external countries. This system is illustrated below.

International Highway Network



B.7.1.4 Speeds and Times on Links

The model is constructed to reflect the speeds at which vehicles travel along existing transport links. In particular, speed of travel in the model should be capable of reflecting the effect of increasing volumes of traffic on the link.

Journey time data has been collected for derivation and calibration of appropriate speed-flow curves for roads within Bulgaria. This consisted of a survey along all major routes between Sofia, Burgas, Varna, Plovdiv, Ruse and Vidin, as well as a small number of shorter routes along less major roads, noting travel times between points.

All class 2 and 3, and most of class 1 roads, have a single lane in each direction. Motorways have two lanes per direction, as do a limited number of class 1 roads. This information has come from examination of appropriate mapping supplemented by local knowledge.

Analysis of the journey time data collected, along with speeds from the Via Michelin website, indicates the following average freeflow (i.e. with no congestion whatsoever) speeds.

Road Link Classifications

Road Type	Average Free Flow Speed	Actual Speed Limit	Congestion factor
Motorway	110 kph	130 kph	9.82 x10 ^ -6
Class 1	79 kph	90 kph	11.00 x10 ^ -6
Class 2	70 kph	90 kph	12.57 x10 ^ -6
Class 3	55 kph	90 kph	0

The response of assignment speed to vehicle flow and heavy-vehicle flow has been calibrated based upon variations in surveyed speed and average annual daily traffic (AADT) along links in the model.

The function used for deriving speed on any particular link is as follows:

$$v = v_f e^{-fV}$$

Where:

v is speed on the link

v_f is free flow speed, dependent upon link type - see table above

f is a congestion factor, dependent upon link type - see table above

V is volume of traffic on link per lane, in passenger car equivalent units (i.e. a car represents 1, a heavy vehicle represents 2), in a 12hr day.

B.7.2 *Bus Network Development*

The bus network within EMME is designed to represent the movements of personal travel by long-distance coach, and to a much lesser extent, more local bus services, within Bulgaria. The latter are included principally to represent access to and egress from longer-distance coach services; it is not a requirement of the model to estimate the total demand for these services. It is used, in combination with a suitable demand matrix, to derive travel times, waiting times, access times, and fares for all possible bus journeys in the model, and levels of passenger flow on all bus routes.

The bus network depends upon the highway network, as the bus services are coded to run along the EMME highway network.

B.7.2.1 Data Sources

The primary source of data for the bus network development has been bus timetable information for the whole of Bulgaria taken from the database underlying the website: http://avtogari.info/. This contains complete timetable information for domestic coach services, as well as a significant number of more strategic local bus services, including both travel and wait times at stops.

In addition to this, we had access to survey data from passengers at bus stations which have been used to derive access information.

International bus service data have been taken from the Automobile Administration website; http://www.rta.government.bg/m_prevozi.html

B.7.2.2 Bus Itinerary Development

An automatic process in Visual Basic was developed to convert the timetable information to EMME format.

As part of the highway network development process, mapping between EMME nodes and towns was created. This was then used to convert the bus timetables.

The coded transit lines are summarised below.

Bus Itineraries Summary

	Transit Lines	Segments	Services /day	Bus km /day
Short (<30km)	200	1,189	1,416	30,671
Long (>30 km)	2,168	81,667	4,467	663,376

B.7.2.3 Access to the Bus Network

For the most part, modelled bus trips are able to use the same centroid connections as highway trips. However, some zones do not contain any coach service stops. Without some intervention, it would be impossible for such trips to access the bus network.

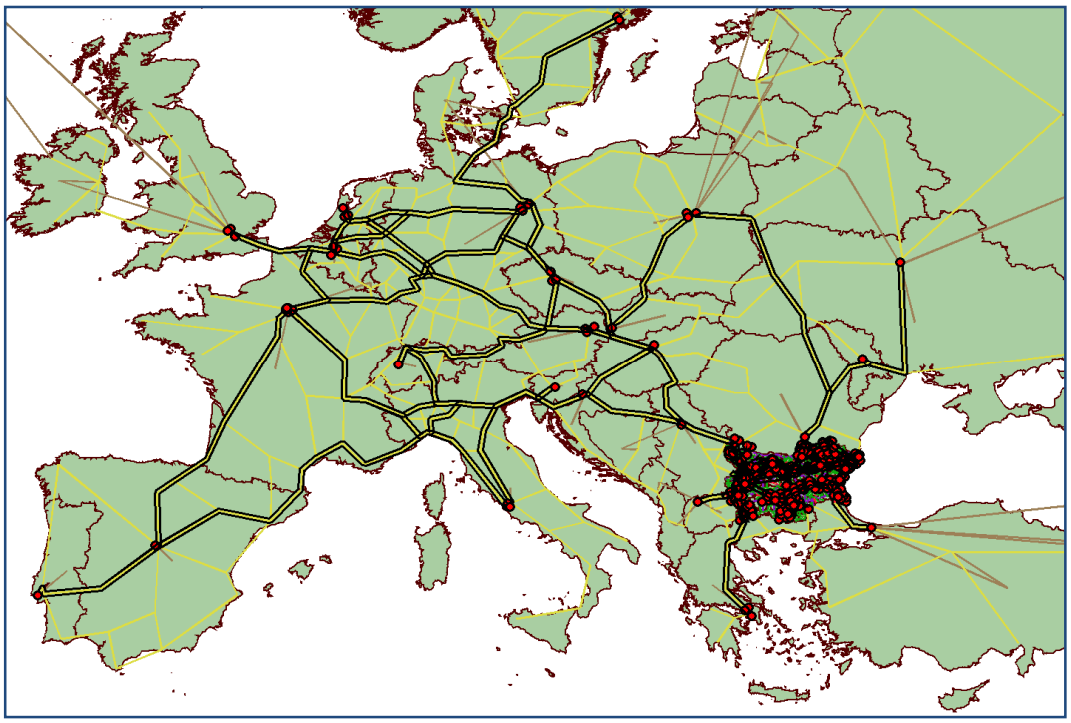
Consequently, we added some additional “inter-zonal” centroid connectors, which allow travellers from zones where no bus or coach services are present to access adjacent zones for the purpose of boarding and alighting from buses.

B.7.2.4 International Bus Travel

International bus services have been coded so as to approximately represent sensible directions of travel from Bulgaria to other locations by bus. The actual timetable was used only for the portion of the journey which takes place within Bulgaria. Outside Bulgaria a fixed speed of 90 kph for travel is assumed. This speed has been determined as a reasonable average speed for international coach travel by inspection of the existing timetable.

Stops have been coded on a national basis; a given service may stop at several cities in Austria, for example, but it is represented in the model by a single stop in the Austria zone. The international bus transit lines are shown below.

International Bus Services



B.7.3 *Rail Network Development*

The rail network within EMME is designed to represent the movements of passenger travel by rail within Bulgaria. It is used, in combination with a suitable demand matrix, to derive travel times, waiting times, access time, and fares for all possible rail journeys in the model, and levels of passenger flow on all rail routes in the model.

Unlike the bus model, which runs along the highway network, the rail model has a network of its own representing the railway system within Bulgaria.

B.7.3.1 Data Sources

The primary source of passenger service data for the rail network development is rail timetable information for the whole of Bulgaria taken from the BDZ website: http://razpisanie.bdz.bg/site/search.jsp

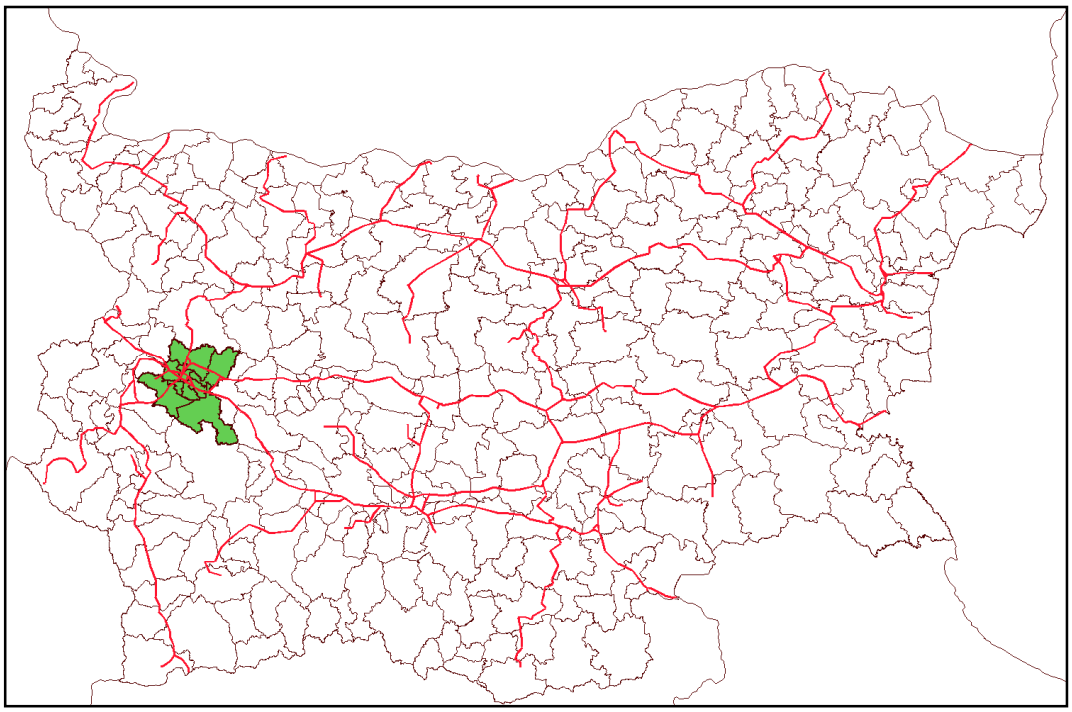
This contains complete timetable information for all domestic rail services, as well as those parts of international services that run within Bulgaria.

The network of railway tracks within Bulgaria has been derived from a MapInfo layer from the same source as the highway network.

B.7.3.2 Rail Network Topology Development

The MapInfo network has been converted to EMME format automatically, using a process very similar to that used for conversion of the highway network. The resulting EMME network is shown below.

Domestic Rail Network



B.7.3.3 Rail Itinerary Development

An automatic process in Visual Basic has been developed to convert the passenger timetable information from BDZ to EMME format.

The coded transit lines are summarised below.

Rail Itineraries Summary

	Transit Lines	Segments	Services /day	Train km /day
Domestic	312	11,031	562	62,041

B.7.3.4 Access to the Rail Network

Centroid connectors for the rail network are specified according to the following principles:

- Zones which have rail network within the zone boundary are connected to the appropriate main station within that zone; and
- Since the model is divided into areas/zones based on the municipalities, in many of these zones there is no rail station. However, passengers from other local areas also use rail services, so they are allocated to the nearest convenient station.

B.7.3.5 International Rail Travel

International rail passenger services have been coded in the same way as domestic services using information on the BDZ website. However, only services which actually run through Bulgaria have been included.

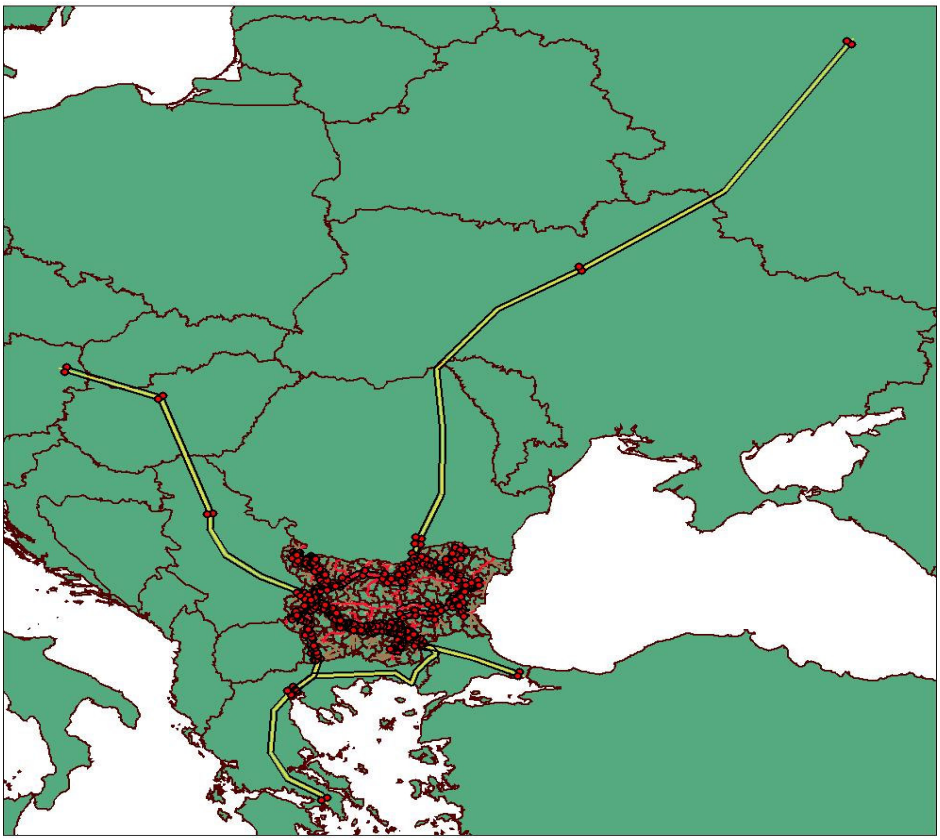
All international services have been assumed to operate at a frequency of once per day. In reality, no international rail service operates with a higher frequency than this, though some are only two to five times per week. It is difficult to represent frequencies of less than once per day properly in the Bulgaria Transport Model because it is designed to represent a single day. As derivation of precise costs for international travel will not be required, this is not considered a serious problem.

Stops have been coded on a national basis; a given service may stop at several cities in Russia, for example, but it is represented in the model by a single stop in the Russia zone.

Only services which operate year-round have been included. Summer-only services have not been represented.

The international rail transit lines are shown below

International Rail Services



Centroid connectors have been provided as appropriate, one per external zone, to allow all external zones to access the international rail network. In most cases, this means connecting the relevant country's zone to the nearest point on the rail network; most zones in Western Europe are connected through Serbia.

B.7.4 *Assignment Procedures*

B.7.4.1 Highway

Travelling vehicles are assigned to the highway network in two groups, or user classes. Light vehicles (including cars of all kinds and light goods vehicles) are distinguished from heavy (that is, freight goods) vehicles.

Traffic is assigned at a 12-hour level, that is, the input demand matrix and the flows on the network represent traffic over the course of a 12 hour day.

Vehicles are assumed to choose paths through the networks that minimise their total cost. Total cost is considered to include both travel time and fuel cost. Non-fuel-based vehicle operating costs are not included. Fuel costs are calculated separately for light and heavy vehicles.

B.7.4.2 Bus and Rail

EMME assigns bus and rail passengers to the network on the basis of service frequencies. Travellers select all possible routes (which may involve changing coaches or trains one or several times) that might allow them to reach their destination with the minimum possible cost, and then allocate themselves to an actual route based on the relative frequencies of the services on each route.

"Cost" does not simply include time spent in a coach or train. It also includes waiting time for services and time spent travelling to and from stations. There is additionally a 10 minute penalty applied to every boarding of a service, to discourage routes that make a large number of changes. This value has been arrived at based on analysis of routing within the model against timetabled best routes between cities from the BDZ website.

Bus and rail assignment is done on the basis of a single user-class; that is, it is assumed that all travellers have the same basic perception of the cost of travel and use the same method to determine the best route to get from their origin to their destination.

Fares are not included as part of the assignment process. This is because fares are generally dependant only upon origin and destination, rather than upon the actual route taken.

B.8 Passenger Travel Behavioural Models

B.8.1 *Context*

The behavioural models within the BPTM predict the response of travellers to changes in the supply network. In particular, they forecast the following responses:

- Mode Choice: This model predicts to what extent travellers will change modes in response to changes in the cost of travel by one or more modes.
- Distribution: This model predicts to what extent travellers will change their choice of destination in response to changes in the cost of travel to various destinations.

Between them, these models permit the forecasting of traveller responses to transport interventions such as the following:

- New roads, such as extensions to Bulgaria's motorway network.
- Increased public transport vehicle speeds or service frequencies.
- Changes to fuel prices or public transport fares.

B.8.2 *Generalised Cost*

The behavioural models require a representation of the generalised cost of a journey, so that they can estimate traveller responses to changes in that cost. Generalised cost in the BPTM consists of two components:

- Travel times, including in-vehicle times, waiting times for public transport services and access and egress times to and from public transport services; and
- Monetary costs, including public transport fares and fuel operating costs for car users.

These two components of cost (time and money) are combined into a single 'generalised cost' figure using values of time.

B.8.2.1 Time

Times for each origin and destination pair are extracted from the highway, bus and rail assignment models. These represent average travel times. For public transport services, it is desirable to weight the various components of travel time (in-vehicle, waiting, access/egress) differently. In particular, waiting and access/egress times are doubled for the purposes of the behavioural models, as it is considered that travellers perceive waiting and walking time to be more onerous than time spent in the vehicle travelling.

B.8.2.2 Monetary Cost

Estimates of fuel cost are derived from assumptions about vehicle fuel efficiency and the price of fuel and are given by the following expression:

$$C = \frac{pl}{e}$$ where

C is the total fuel cost for a journey in eurocents

p is the price of fuel in eurocents per litre

l is the length of the journey in kilometres

e is the vehicle efficiency in kilometres per litre

Both p and e are assumed to change over the course of time: i.e. they are different for different modelled years.

Public transport fares are estimated using the following expressions. The expressions are standard for this type of analysis and are calculated as a price per kilometre plus a constant. In both cases the distance is in kilometres and the output fares are in eurocents.

$$RailFare = 1.74 * Distance + 101$$

$$BusFare = 3.07 * Distance + 123$$

Again, these fares are assumed to vary by modelled year, and can be adjusted for testing specific public transport fare schemes.

The functions above have been derived from an extensive collection of fares data from BDZ and all major coach operators.

B.8.2.3 Values of Time

An understanding of how travellers are willing to trade off time against money is also required. This is achieved by the use of values of time, which can be used to convert monetary costs to a time equivalent. The behavioural models use time in minutes for calculations, so all costs must be expressed in minutes.

Values of time vary by purpose, and have been taken from "Requirements for preparation of CBA in Transport sector". They are illustrated below.

Values of Time (in 2008 prices)

Purpose	Value of Time per person (eurocents per minute)
Business	19.77
Leisure	7.30
Commuting	7.30

Total cost in minutes in therefore given by the expression below:

$C = t + \frac{m}{V}$ where

C is total cost

t is travel time in minutes

m is monetary cost in eurocents

V is value of time as given in the table above

B.8.2.4 Generalised Cost Summary

For car trips:

$$C = t + \frac{pl}{eV}$$

For public transport trips:

$C = t_i + 2t_w + 2t_a + b + \frac{f}{V}$ where

f is the fare

t_i is the time spent in a coach or train, t_w is the waiting time, t_a is the access and egress time, b is a boarding penalty of 10 minutes per service boarded.

This latter serves to discourage journeys with excessive numbers of changes, to reflect travel behaviour.

B.8.3 Mode Choice and Distribution Models

The basic concept of the behavioural models is that

$D_o = f(D_I, \Delta C)$ where

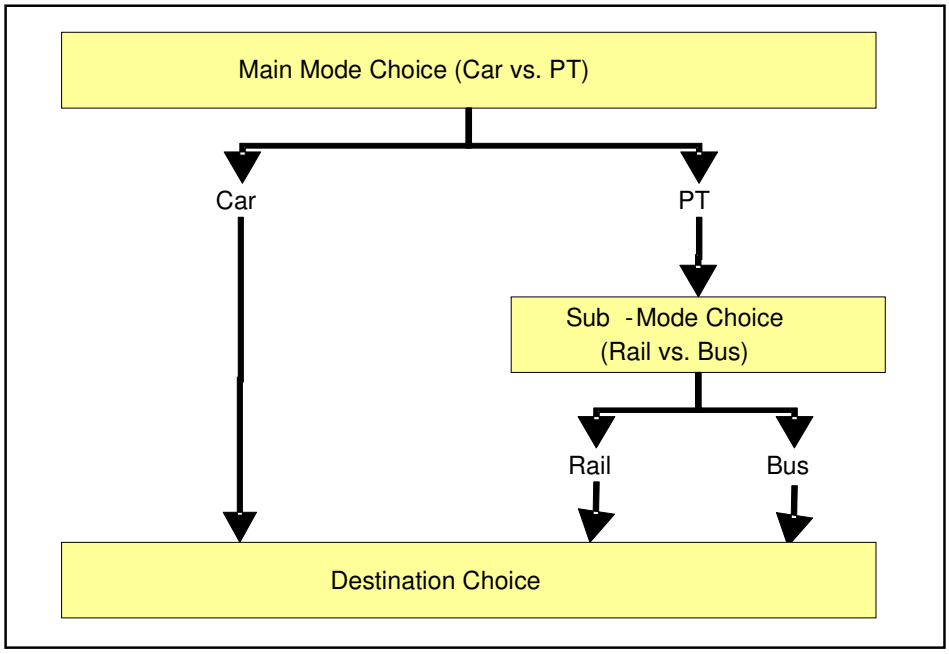
- D_o is output demand
- D_I is input reference demand

- ΔC is generalised cost change from base (that is, base-year) to test (that is, whatever scenario is to be tested).
- $f(\ )$ represents a function of the contents of the bracket

The models are constructed so that if $\Delta C = 0$, then $D_o = D_I$, i.e. if there is no change to transport costs and patterns of demand do not change.

The diagram below illustrates the process. Firstly, one set of equations divides trips between car and public transport, and then secondly another set divides public transport trips between rail and bus. Finally, a third set determines the destination of all trips.

Behavioural Model Structure



B.8.4

Logit Formulation

The basic formulation (known as an incremental logit) of the equations used in the behavioural models is detailed below:

$$D_O = \sum D_I \frac{D_I e^{\lambda \Delta C_I}}{\sum D_I e^{\lambda \Delta C_I}}$$ where

D_O is output demand

D_I is input demand

ΔC_I is the input change in cost

λ is the sensitivity parameter

For example, in the case of main mode choice, the summations in the equation should be taken as over main modes, and the output demand is derived as car and public transport. In the case of destination choice, the summations are over all destinations.

B.9 BPTM Validation

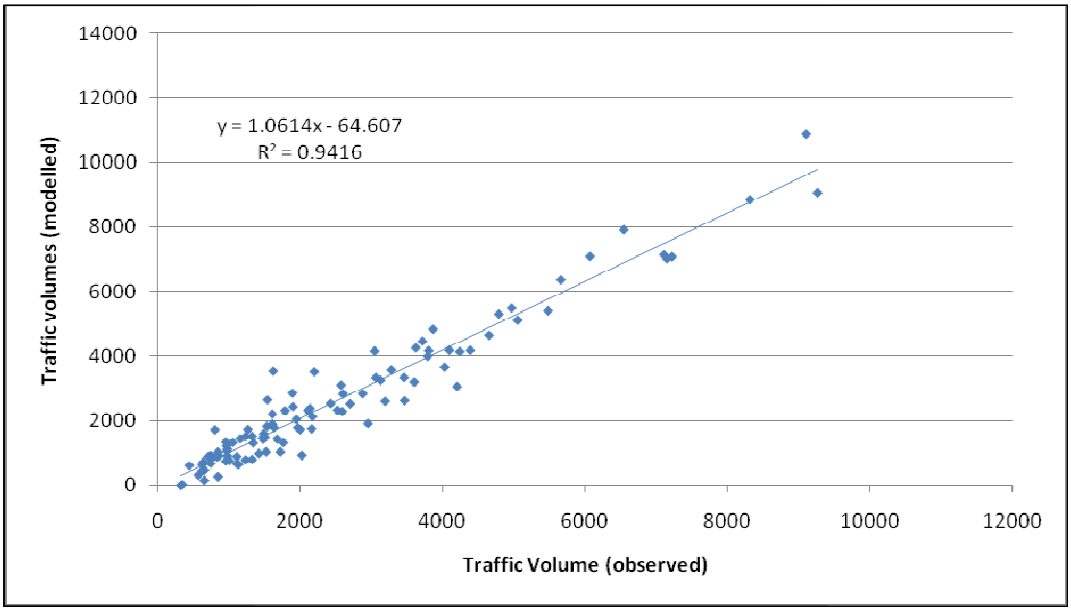
Validation is the comparison of model outputs against other sources of data to demonstrate that the model is robust and accurate.

B.9.1 Highway Model Validation

One key validation exercise is to check that traffic flows counted at particular points on the network are matched by the values output from the assignment model.

We have access to such data, in the form of AADT (average annual daily traffic) counts conducted on 114 stretches of road in 2007 (source: Central Roads and Bridges Laboratory). Although these data are not directly comparable with our model (being a different year and 24hour rather than 12hour volumes), it is possible to estimate 2008 12hr vehicle traffic from them, and compare with that modelled. This comparison is shown below.

Assigned Volumes versus AADT Counts



Validation comparisons were also made between:

- Modelled and observed travel distances;
- Modelled and observed travel times;
- Modelled and observed inter-sector travel demand.

In each case the correlation was good

B.9.2 Bus and Rail Models Validation

Direct validation against existing data for the public transport models was more difficult. We were able to compare totals of trips and vehicle kilometres for buses in the model against those reported in the NSI yearbook.

Trip and Vehicle Kilometre Validation, 12 hours

	Modelled	NSI Yearbook (2006)
Bus Trip Total	274,027	303,279
Bus Passenger Kilometres	16,925,319	19,440,931

This is a good validation, particularly as coach passenger levels have been falling fairly rapidly from 2002-2006.

The NSI yearbook for 2005 quotes the number of passenger train kilometres as 23,819,000. The model currently has 62,041 passenger train kilometres for one day. Assuming the same number every day this implies 22,660,000 km per year. This is an excellent validation, demonstrating the completeness and accuracy of the rail timetable data in the model.

B.9.3 *Behavioural Models Validation*

The response of the behavioural models can be analysed by changing some aspect of transport infrastructure and observing the effect upon demand. We have performed three such sensitivity tests:

- A reduction in car fuel costs of 10%.
- A reduction in public transport fares of 10%.
- A reduction in car journey times of 10%

All of these are standard practice in European behavioural modelling.

We analyse the results by calculating elasticities, which measure how one variable (here, person kilometres) changes with respect to another (fuel cost, journey time or fares). The expression is as follows:

$$elasticity = \frac{\log_e\left(\frac{km_t}{km_b}\right)}{\log_e\left(\frac{v_t}{v_b}\right)}$$

where:

- km_t is the person kilometres for the appropriate mode (car for fuel cost and journey time; PT for fares) in the test case (i.e. with the 10% adjustment);
- km_b is the person kilometres for the appropriate mode in the base case (i.e. without any changes);
- v_b is the base value of the variable for which the elasticity is being calculated (fuel cost, rail fares, journey time, etc.); and
- v_t is the test value of that variable.

The table below reports the results of these sensitivity tests.

Elasticities to Sensitivity Test Variables

Sensitivity Test	Commuting	Business	Leisure
Car Fuel Cost -10%	-0.329	-0.269	-0.612
Public Transport Fare -10%	-0.165	-0.120	-0.322
Car Journey Time -10%	-0.428	-0.951	-0.990
Rail Journey Time -10%	-0.294	-0.749	-0.775

All of these values are credible and sensible. Fuel cost elasticities are greater than UK experience (of around -0.3); this is intuitive; because income-levels (and therefore willingness to pay for fuel) are much lower in Bulgaria. Public transport fare elasticities are lower than UK experience (around -0.4); this is because Bulgarian public transport fares are themselves much lower than in the UK (by a greater margin than incomes). Journey time elasticities are comparable with UK experience as might reasonably be expected.

B.10 Freight Modelling Methodology

B.10.1 *Freight Modelling Methodology Overview*

A spreadsheet-based freight model has been developed for modelling the level of freight movement in Bulgaria for the 2008 Base Year.

The model was developed based on a database established through the collection of historic data on freight movement, and the relevant socio-economic data, as well as surveys undertaken as part of the study.

B.10.2 *Spatial Aggregation of Freight Demand*

The basic methodology was to model freight movements using a simplified Origin and Destination matrix. The spreadsheet based freight model allows for modelling the base year demand, and also factoring growths by origin, destination or origin destination pair, at regional level.

The Origin Destination Matrix comprises of 23 zones; 11 within Bulgaria and 12 external to the country.

B.10.3 *Freight Modelling Data Sources*

Key sources of data for modelling freight transport included:

- Roadside interviews and traffic counts at 41 sites on main roads around Bulgaria, as well as traffic counts alone at a further 26 sites. These include all major border-crossings;
- Road and rail network topologies from MapInfo layers acquired from the GIS Company; "GfK GeoMarketing";
- Demographic data from National Statistics Institute (NSI) year book, 2007;
- Rail freight statistics provided by BDZ, 2007;
- Statistics of GVA by commodity group and by Bulgaria region, from the Eurostat website;
- Statistics of GVA by commodity group and freight demand of other countries, from Eurostat website;
- Statistics of GDP from Bulgaria National Statistics Institute (NSI) website, 2007;
- Statistics of GDP from the Economist website for countries other than Bulgaria, accessed January 2009;
- Statistics on empty running and backloading, from Eurostat website;
- Statistics of freight movement by commodity type from NSI website, 2007;
- Information on imports, exports, and transit freight movements through Bulgaria sea ports (Varna and Burgas) and ports along the River Danube, provided by the Bulgaria Ministry of Transport, 2003 to 2007;
- Information on competing ports (Thessaloniki and Constanta), from Eurostat website;
- Information on current air freight tonnages, from Eurostat website;
- Boeing (2008) World Air Cargo Forecast, http://www.boeing.com/commercial/cargo/ Accessed 24/03/2009;
- Airbus Global Market Forecast (2008) http://www.airbus.com/en/corporate/gmf/ Accessed 24/03/2009; and
- Conway, Peter (2006) Europe's New Frontier, Air Cargo World, http://www.aircargoworld.com/archives/features/2_jul06.htm, Accessed 24/03/2009.

B.10.4 *Transport Modes*

Base year freight demand has been estimated separately for road, rail, ports and water freight via the River Danube. The freight demand segments and modes that have been considered in the freight model include the following:

- Road freight transport – Domestic and International (including Imports, Exports and Transit);
- Rail freight transport – Domestic and International (including Imports, Exports and Transit);
- Road and rail traffic to/from the sea ports (including Imports, Exports and Transit);
- Sea freight via the Ports;
- Water freight via the River Danube; and
- Air Freight.

The origins and destinations of road freight movements were recorded as part of the Roadside Interviews (RSI's).

For rail freight demand, the origins and destinations of BDZ rail freight have been factored on to the network and this has been allocated to the main rail routes. An estimation of the tonnage and origins and destinations for goods carried by other carriers has been made and added to this.

The tonnage and types of goods moving along the River Danube are also known using information provided by the Bulgarian Ministry of Transport.

The methodology used to predict the growth in transport by other modes was the same as described above and will be based primarily around the future growths in the commodities which are predominantly carried by rail and water.

It should be noted that, unlike the modelling of passenger demand, a mode-based freight modelling approach was adopted rather than having a mode choice model. This is because a switch between modes takes a longer length of time for freight than for passenger transport (supply chains are reviewed

on average every 5 years); therefore mode choice is affected more slowly for freight following new development or changes in cost. A full instantaneous mode choice model is therefore not appropriate for freight transport.

Our adopted approach has been to using the established database in conjunction with changes to transport supply to assess modal transfer as a result of changes in competitiveness.

The freight model is linked to the passenger transport model in that:

- Both freight and passenger transport models are developed based on a common technical database established as part of the study, including population, GDP, and level of demand of goods vehicles etc; and
- The heavy goods vehicle (HGV) demand matrix estimated from the freight model is used as input to the passenger transport model within the highway assignment module, so that the impacts of HGV volumes on highway journey times, and routing choices are reflected in the assignment.

Air freight is not modelled specifically in the freight model, but is analysed separately based on research into various sources of data on airport statistics and growth forecasts.

Appendix C- Acronyms and Abbreviations

AADT	Annual Average Daily Traffic
AGTC	European Agreement on Important International Combined Transport Lines and Related Installations
AQMA	Air Quality Management Area
ARI	Agency for Roads Infrastructure
ATSA	Air Traffic Services Authority
BCR	Benefit to Cost Ratio
BDZ	Bulgarian State Railways
BFTM	Bulgaria Freight Transport Model
BGN	Bulgarian Lev
BPTM	Bulgaria Passenger Transport Model
BTM	Bulgaria Transport Model
CAA	Civil Aviation Administration
CBA	Cost Benefit Analysis
CCTV	Closed Circuit Television
CF	Cohesion Fund
CHH	Cultural Historic Heritage
CO_2	Carbon Dioxide
CRBL	Central Roads and Bridges Laboratory
D2AP	Dual Two Lane All-Purpose Road
EA	Environmental Assessment
EAMA	Executive Agency Maritime Administration
EC	European Commission
EDI	Electronic Data Interchange
EEA	Executive Environmental Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMME	Equilibre Multimodal, Multimodal Equilibrium
ER	Environmental Report
ERDF	European Regional Development Fund
ETEC	Expert Technical Economic Council
EU	European Union
FRAPORT	Frankfurt Airport
FYROM	Former Yugoslavian Republic of Macedonia
GDP	Gross Domestic Product
GTMP	General Transport Master Plan
GVA	Gross Value Added
HEATCO	Harmonised European Approaches for Transport Costing and Project Assessment
HR	Human Resources
HSA	Hygiene Secured Areas
IAPH	International Association of Ports and Harbours
ICAO	International Civil Aviation Organisation
IDA	International development Association
IMF	International Monetary Fund
ISO	International Standards Organisation
ISPA	Instrument for Structural Policies for Pre-Accession
JASPERS	Joint Assistance to Support Projects in European Regions
JBIC	Japan Bank for international Cooperation
KPI	Key Performance Indicator
LRT	Law on Railway Transport
MCC	Manual Classified Count
MFL	Minimum Friction Level
MH	Ministry of Health
MIDT	Marketing Information Data Transfer
MoE&W	Ministry of Environment and Water
MoT	Ministry of Transport
MoTITC	Ministry of Transport, Information Technology and Communications
NATO	North Atlantic Treaty Organisation
NO_X	Nitrous Oxide
NPDPTP	National Programme for Development of Public Transport Ports
NPV	Net Present Value

NRIC	State Enterprise National Railway Infrastructure Company
NRIF	National Road Infrastructure Fund
NS	National Strategy for Integrated Development of the Infrastructure of the Republic of Bulgaria
NSI	National Statistical Institute
OPT	Operational Programme Transport
PA	Protected Area
PCN	Pavement Classification Number
PFI	Private Finance Initiative
PHARE	Programme of Community aid to the countries of Central and Eastern Europe
PIANC	Permanent International Association of Navigation Congresses
PPP	Public Private Partnership
PT	Public Transport
PT	Protected Territory
PVC	Present Value of Costs
RAFD	Regional Agriculture and Forests Directorates
RAQAM	Regions for Air Quality Assessment and management
RIEW	Regional Inspectorate for Environment and Water
RICPPH	Regional Inspectorate for Control and Protection of Public Health
Ro/Ro	Roll-On Roll-Off
RSI	Roadside Interview Survey
S2AP	Single Two Lane All-Purpose Road
SEA	Strategic Environmental Assessment
SMS	Safety Management System
SOPT	Sectoral Operational Programme Transport
SSA	Sanitary Secured Area
SWOT	Strengths Weaknesses Opportunities Threats
TEN-T	Trans-European Transport Network
TEU	Twenty Foot Equivalent Unit
VTMIS	Vessel Traffic Management Information System