Rehabilitation of the Ruse-Varna railway line

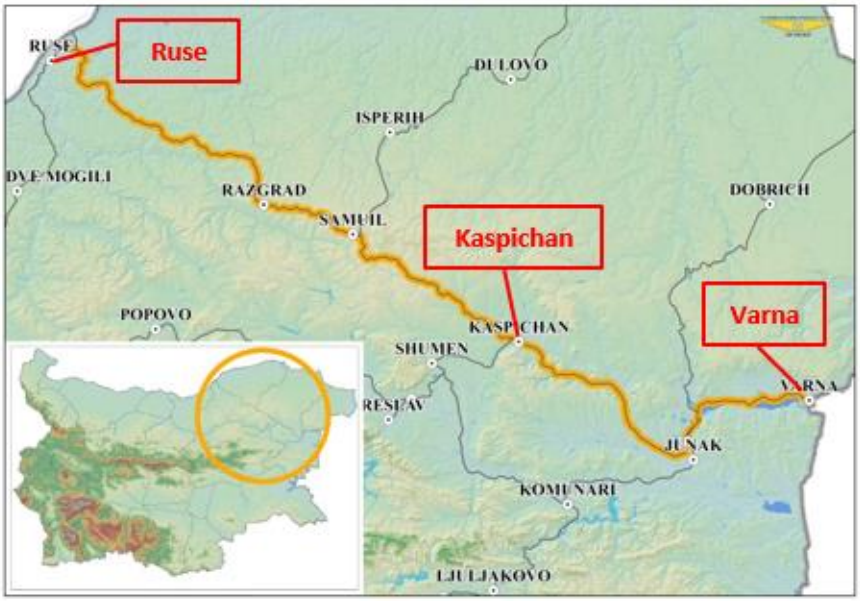
General information

This project regards the **rehabilitation of the Ruse-Varna railway line**.

The Ruse-Varna railway was the first line to be built in Bulgaria, in 1866. The line is approximately 232 km long and consists of two main sections: Ruse-Kaspichan and Kaspichan-Varna (see Figure 7-1).

The Ruse-Varna railway is part of the TEN-T Comprehensive Network. It is a very important link, being the unique connection between the cross-border river port of Ruse (i.e., on the Danube River) and the Black Sea port in Varna[1]. On the Romanian side (i.e., FR8), the section **continues along the Giurgiu-Bucharest line**.

Figure 7-1: Location of the railway line Ruse-Varna



Source: NRIC

The rehabilitation of the Ruse-Varna railway line shall contribute to the improvement of freight and passenger mobility between Bulgaria and Romania, as well as with the neighbouring EU Member States. The **main objectives** of this project are:

- to increase rail transport services quality, reliability and safety due to the improved technical parameters and the interoperability of the line as part of the EU network;
- to create the conditions for the development of intermodal sea-railway-river transport, contributing to the promotion of intermodality, by enhancing the connection of two main ports in Bulgaria, one maritime and one a river port;
- to stimulate the economic growth of Bulgaria through reliable passenger and freight railway transport;
- to optimise the capacity and efficiency of the existing infrastructure;
- to integrate environmental concerns in the design and implementation of the TEN-T Network.

[1] Both are included in Annex II of Regulation EC 1315/2013 (i.e., List of nodes of the Core and Comprehensive Networks).

The project was developed on the revised TEN-T policy, in order to **eliminate a bottleneck** of the interconnections between the South-Eastern region of the EU and the EU neighbouring countries.

Besides, the project also aims to cope with the increasing transport demand, as the latest traffic forecasts show significant increments of traffic volumes on the relation served by the line.

The project is included in the following important **strategic documents**: (i) EUROPE 2020 strategy, (ii) the New White Paper on EU Transport Policy (2011), (iii) the Revision of Guidelines for Trans-European Network for Transport; (iv) the National Transport Strategy of the Republic of Bulgaria up to 2020, (v) the Strategy for the development of the transport infrastructure of the Republic of Bulgaria to 2020, (vi) the Long-term programme for the development of the railway infrastructure 2011-2020 and (vii) in the General Transport Master Plan of Bulgaria.

Additionally, the development of this project is directly connected to the investment project "Construction of the Intermodal terminal in Central-North Planning Development Region in Bulgaria - Ruse", which is included in the list of priority projects of the Operational Programme Transport and transport infrastructure 2014-2020.The project is in conformity with the transport policy of the EU. The project preparation started with a financing from the TEN-T Programme Annual Call 2007 amounting to € 1,3 million (i.e., 50% of the estimated costs of the studies)[2].

In order to achieve the maximum effect of future rehabilitation works, in 2014 the approved rehabilitation programme has been revised. This was necessary also to meet the requirements for achievement of interoperability in accordance with Bulgarian legislation (i.e., Regulation n. 57[3]).

The **project promoter** is the State Enterprise National Railway Infrastructure Company (NRIC).

Technical description

The length of railway line Ruse-Varna is approximately 230 km long, with a design speed between 70-130 km/h. In 1983, the line was electrified.

Regarding the technical characteristics of the two main sections, the relevant information is summarised below.

- The **Ruse-Kaspichan** section:
  - → 141 km long, single track and electrified;
  - → the section includes 5 bridges, 14 culverts, 2 road overpasses and 3 road underpasses;
  - → the existing design speed is 70-95 km/h;
  - → the longitudinal gradients are up to 25 ‰.
- The **Kaspichan-Varna** section:
  - → 85 km long, double track and electrified;
  - → the section includes 22 bridges, 12 culverts, 3 road overpasses;
  - → the existing design speed is 100-130 km/h;
  - → the longitudinal gradients are up to 25 ‰.

[2] The action "Technical assistance for restoration of the design parameters of the Ruse-Varna railway line (2007-BG-90302-S)" has been completed in 2011. The following deliverables were prepared: the Feasibility Study (including traffic analyses and demand forecasts), the Technical Design for the rehabilitation of the Ruse-Varna Railway line, the economic and financial analyses and the Decision of the Ministry of Environment and Water (MEOW) not to undertake a full EIA for this investment proposal.

[3] Building of facilities for people with reduced mobility.

Currently there are technical designs for the project that were prepared between 2009 and 2011[4] and revised in 2014. The main activities to be completed for the rehabilitation of the line are as follows:

- design and construction works for the rehabilitation of the railway structures and renewal of superstructures[5];
- rehabilitation of the catenary;
- rehabilitation of five power substations and five sectioning posts;
- station buildings rehabilitation;
- implementation of ERTMS and GSM-R;
- construction of the Dispatching Centre for Centralised Traffic Control and Electric Traction Power Supply Control in Gorna Oryahovitsa, with two workplaces/warehouses for the railway line Ruse-Varna.

It is also planned the construction of Monitoring Control Systems, security level "SIL4" and telecommunications equipment for dispatching connections. Once completed, the line will be compliant with the requirements of EC Regulation 1315/2013.

Four project alternatives were identified relying on a comparative analysis that considered the investment cost and other costs during the life cycle of the project, as well as Financial and Cost Benefit Analyses. The alternatives are:

- **B1:** assessed with regard to the electrical systems identically as for version B2 for introducing GSM-R and ETCS level 1. The number of stations is the same. In order to optimise the investments, renovation and repairs works are envisaged for some sections).
- **B2:** envisaged a complete renovation of the railway from Ruse to Varna, including the doubling and electrification of the alignment Karnobat-Sindel. The safety equipment and the telecommunications are for GSM-R and ETCS level 1, with the possibility of upgrade in the future. The traction substations will be prepared for connecting into SCADA (i.e., Supervisory Control and Data Acquisition).
- **C1:** assessed with regard to the electrical systems identically as for version C2 for introducing GSM-R and ETCS level 2.
- **C2:** complete renovation of the railway along the section from Ruse to Varna. Yasenovets, Velino, Nevsha and Solna stations are fully recovered. The security equipment and the telecommunications conform to the requirements for introducing of GSM-R and ETCS level 2. With regards to the electrification system, the renovation of the entire catenary and the modernisation of 5 traction substations, connecting to the SCADA system is foreseen.

Based on the latest project revision, **the identified project alternative is B1, with an estimated investment cost equal to € 383 million**. Information is not available regarding investment cost breakdown and operating and management costs, as well as for the estimated costs of the other alternatives.

[4] Action Technical assistance for restoration of the design parameters of the Ruse-Varna railway line-2007-BG-90302-S.

[5] Renewal of the superstructure in open track and main station tracks and turnouts with UIC 60 E1 rails. Superstructure in secondary station tracks with rails UIC 49 E1 and second-hand reinforced concrete sleepers from the existing track.

Project implementation

The investment project will be implemented under the construction and services contracts. Separate tenders are envisaged to be launched for the selection of the contractors, in accordance with the Public Procurement Act of Bulgaria. The planned tenders are as follow:

- Rehabilitation of railway infrastructure along Ruse-Kaspichan railway line;
- Rehabilitation of railway infrastructure along Kaspichan-Varna railway line:
  → LOT 1: Rehabilitation of railway infrastructure along railway section Pliska-Kaspichan;
  → LOT 2: Rehabilitation of railway infrastructure along railway section Kaspichan-Provadiq;
  → LOT 3: Rehabilitation of railway infrastructure along railway section Razdelna-Povelianovo;
- Renewal of five Power Supply Sub-stations and five sectional posts along Ruse-Varna railway line:
  → LOT 1: Design, supply and installation of equipment for renewal of Traction sub-sections Chervena Voda, Razgrad and Hitrino, including sectional posts Ruse, Krivinq, Samuil;
  → LOT 2: Design, supply and installation of equipment for renewal of Traction sub-sections Provadiq and Varna, including sectional posts Kaspichan and Sindel.
- Design and build of signalling and telecommunications systems and of GSM-R;
- Design and build of GSM-R;
- Construction supervision, compliance assessment and coordination of the construction works;
- Construction and installation of SCADA;
- Assessment of compliance with the interoperability requirements;
- Archaeological studies and monitoring during construction works;
- Information and publicity for the project "Rehabilitation of the Ruse-Varna railway line".

The **construction period** is of 4 years, from 2010 to 2014.

Transport demand

The **transport demand analysis** and forecasts were based on a modelling exercise[6]. The forecasts cover a 30-year period, from year 2010 to 2040. The forecasts were elaborated with respect to key socio-economic and trade transport drivers. The adopted approach consists of:

- traffic modelling as of the base year and assignment to base year networks;
- forecasts of main socio-economic variables that influence the transport demand and definition of growth per markets segments;
- forecasts of total future transport demand;
- modal split of future demand;
- assignment to future networks.

Forecasts of key **socio-economic drivers** that influence transport demand were carried out on the basis of available official national and international sources, based on the following assumptions:

- the national GDP of 2007 equal to 100, the national GDP of 2040 was estimated equal to 282 (i.e., an annual growth of about 3,2%);
- the population of Bulgaria of 2040 was projected to decrease up to some 6,3 million inhabitants;

[6] Developed using the VISUM software.

The rail demand at national level was expected to grow by some 120% in 2040. The generated and diverted traffic was calculated based on the difference in the generalised costs during the rail operation period 2015-2040.

The main **results** of traffic assignment for the base year of 2010 are as follows:

- the annual number of passengers on the Ruse-Kaspichan section is about 270 thousand, or on average some 740 passengers/day, while in the following section Kaspichan-Varna it is almost 5 times higher (i.e., about 1,35 million/year, or some 3.700 passengers/day);
- the annual freight volume transported is in a relatively narrow range, from 920 thousand tonnes/year on Ruse-Kaspichan section, to 1.085 thousand tonnes on Kaspichan-Varna section. The most traffic intensive section is the Sindel-Razdelna-Povelianovo, with 1.6 million tonnes/year. The main commodities currently transported along the line are petroleum products and construction materials, followed by chemicals.

In order to reflect the changes resulting from the rehabilitation works, the new railway network was modelled to reflect the technical characteristics (i.e., route, length, design and commercial speeds for both freight and passenger traffic). The forecasted traffic demand matrices were assigned on the sections of the line and resulted in the estimated passengers and freight volumes as summarised in Table 7-1 and Table 7-2.

Table 7-1: Estimated passenger traffic of the Ruse-Varna railway line

Section	Passengers				
	Base year	2015	2020	2030	2040
Total Ruse-Varna	667.932	813.052	896.667	1.116.718	1.386.165
Compared with base year	100%	122%	134%	167%	208%
	Passengers·km				
Total Ruse-Kaspichan	38.423.819	48.606.398	53.480.282	66.600.991	84.902.200
Total Kaspichan-Varna	112.786.598	135.479.158	149.536.690	186.238.513	228.943.579
Total Ruse-Varna	**151.210.416**	**184.085.556**	**203.016.972**	**252.839.504**	**313.845.778**

Source: NRIC

Table 7-2: Estimated freight traffic on the Ruse-Varna railway line

Section	Tonnes				
	Base year	2015	2020	2030	2040
Total Ruse-Varna	982.404	1.217.636	1.311.585	1.450.311	1.549.408
Compared with base year	100%	124%	134%	148%	158%
	Tonnes·km				
Total Ruse-Kaspichan	131.079.184	153.334.316	162.297.227	181.383.791	195.062.614
Total Kaspichan-Varna	91.349.815	122.354.303	134.662.615	146.985.475	155.743.504
Total Ruse-Varna	**222.428.999**	**275.688.619**	**296.959.842**	**328.369.265**	**350.806.118**

Source: NRIC

Financial analysis

The financial analysis was elaborated according to the Working Document 4 (EC, 2006) and the Guide to Cost-Benefit Analysis of Investment Projects of the DG Regional Policy (EC, 2008). As indicated in the Guide to CBA, the time-horizon assumed for the financial analysis is 30 years, from year 2010 to year 2040. The construction period is of 4 years, from 2010 to 2014. A financial discount rate of 5% has been used.

An incremental approach was applied to calculate the FNPV and FIRR at a discount rate of 5%. The **results** of the financial analysis are summarised in Table 7-3.

Table 7-3: Financial performance indicators of the project of the Ruse-Varna railway line [€]

Indicator	Alternative B1	Alternative B2	Alternative C1	Alternative C2
FNPV C	-366.625.411	-359.394.849	-586.448.210	-648.969.823
FIRR C	-1,88%	-1,78	n. a.	n. a.
FNPV K	-74.658.059	-67.150.950	-120.881.701	-133.552.899
FIRR K	2,44%	2,51%	1,74%	1,39%

Source: NRIC

There is no information available with respect to the sensitivity and risk analyses. From the documents made available, it is not possible to identify the envisaged source of financing.

Economic analysis

The economic analysis has been carried out in compliance with the guidance documents of the EU (EC, 2008; EC, 2006). The time-horizon and the construction period are the same assumed for the financial analysis. As recommended in EC (2006), the discounting rate of 5,5% has been used for the CBA. The economic analysis is carried out using the incremental method based on the difference of the economic parameters between the "without" and "with" project scenarios.

The **values of time** for passengers and freights are shown in Table 7-4.

Table 7-4: Value of Time

Type of travel	Unit values [€] per passengers·hour and tonnes·hour
Business trip	11,59
Other	4,08
Freight - railway	0,40
Freight - automotive	1,1

The **results** of the economic analysis are summarised in Table 7-5.

Table 7-5: Economic performance indicators of the project of the Ruse-Varna railway line

Indices	Alternative B1	Alternative B2	Alternative C1	Alternative C2
ENPV [€]	59.066.536	-70.565.962	-38.812.871	-168.047.932
EIRR	7,14%	3,64%	4,66%	1,71%
B/C	1,21	0,79	0,91	0,63

Source: NRIC

The ENPV value is most strongly impacted by the size of the investments and the Value of Time (i.e., VoT). The VoT contributes for 63% to the total economic benefits.

The **sensitivity analysis** shows that the project is economically viable, even in the event of an increase of 20% in the investment costs.

On the basis of these results, **Alternative B1** ended up as the most economically viable solution.

Environmental analysis

As a result of the conducted procedures for assessment of the necessity of the EIA implementation, the competent authority, namely the Ministry of Environmental and Waters (i.e., MOEW), issued Decision n. 9-PR.2010 stating that **it is not necessary to carry out EIA for this project**.

Regarding the above, it is worth remarking that according to the Bulgarian legislation in the field of environmental protection, the decision is in force for a period of five years. Therefore, the procedure for the assessment of the necessity of the EIA implementation should be carried out again.

Finally, the project implementation does not modify the existing alignment and no land acquisition is required.

Safety levels

Optical cable is installed only in the section Varna-Kaspichan. Currently, the telecommunications links are made through trunk copper cables. Signalling equipment in the stations is currently worn out and, for this reason, the project includes:

- the construction of computer interlockings in the stations;
- the construction of Dispatching Centre for Centralised Traffic Control and Electric Traction Power Supply Control in Gorna Oryahovitsa;
- the installation of ERTMS ETCS level 1; GSM-R and SCADA.

NRIC will establish a **system for monitoring and controlling parameters of the rolling stock**. This system will be constructed as a radial structure, which contains local control information points. The information will be submitted to the sectional and common centre, whose main functions are to take operational decisions, to collect and archive data and to elaborate statistical reports.

It is envisaged the construction of 27 control points situated along the whole railway network in Bulgaria. Depending on the necessity of the separate control hot points, different parameters shall be monitored such as the identification of the vehicle, wheel loading and wheel flats, hot axle box, hot points and overheated brakes.

The construction of such points within the scope of the current project for rehabilitation of the Ruse-Varna railway line is envisaged for stations Ruse, Razdelna and Samuil. By the installation of this system, the conditions for continuous objective monitoring of train operation and rolling stock will be created. As a result, it will be ensured safety transportation and accidents and incidents will be more effectively prevented.

There is no specific information on safety issues and black spots, before and after project implementation.