Construction of the Struma Motorway Lot 3.2

General information

This project regards the **construction of Lot 3.2 of the Struma Motorway**. The Struma Motorway carries the heaviest volume of traffic of any other route crossing Bulgaria in the North-South direction. It connects six of the largest cities in the western part of the country (i.e., Sofia, Pernik, Blagoevgrad, Vratsa, Montana and Vidin). The Struma Motorway is also part of the Orient/Est-Med CNC[1].

The motorway completion is important from a strategic point of view for the **regional development** of Bulgaria and the bordering countries. It provides a direct route through Bulgaria to the Aegean Sea. Besides, the motorway will provide significant improvements to the road network of South-East Europe and will create conditions for enhanced cooperation between the countries in the Southern Balkans area. Moreover, as regards the relevance of the project, the completion of the Struma Motorway is also mentioned in the Strategy for the Development of the Transport System of the Republic of Bulgaria until 2020 (2010), as a priority project.

The Struma Motorway is approximately 126 km long and divided into four major lots:

- Lot 1 from Dolna Dikanya to Dupnitsa (i.e., 17 km);
- Lot 2 from Dupnitsa to Blagoevgrad (i.e., 37 km);
- Lot 3 from Blagoevgrad to Sandanski (i.e., 57 km);
- Lot 4 from Sandanski to the Greek border crossing at Kulata (i.e., 15 km).

Specifically regarding the Lot 3, this is divided into three subsections as follows:

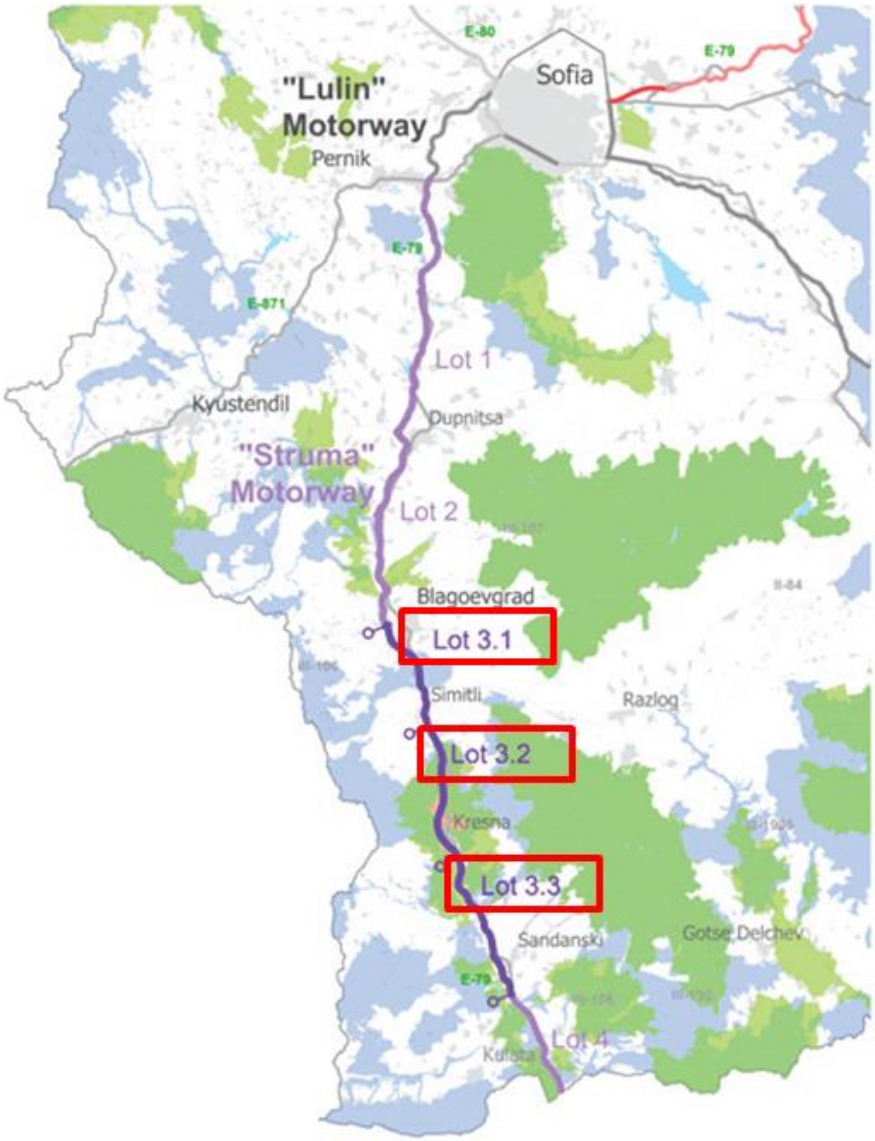
- Lot 3.1 from Blagoevgrad to Krupnik (i.e., 12,6 km), incorporating the Tunnel at Zheleznitsa (i.e., 2 km);
- **Lot 3.2 from Krupnik to Kresna (i.e., 21 km)**;
- Lot 3.3 from Kresna to Sandanski (i.e., 23,6 km).

The alignment of the Lot 3 of the Struma Motorway (see Figure 7-1) is located within an environmentally sensitive area. Most of the route runs near the flood plain of the Struma river and through the transport corridor which includes the existing E79 road and the Sofia-Kulata railway. There are intersections with the E79 and other roads, as well as numerous structural crossings of roads, rivers, railway lines and watercourses.

The existing road cannot accommodate peak traffic levels, which results in traffic congestions in weekend and holiday periods. The combination of low technical characteristics of the existing road and high demand together with a high share of HGVs leads to a much higher accident rate compared with the country average. The lack of feasible alternative routes blocks domestic and international traffic in case of road accidents. Intensive traffic, and especially HGVs, produces considerable harmful emissions. This, together with the noise and damages to surrounding environment in the residential areas and to the other mentioned hurdles, requires particular measures as to relief the mobility of this important axis.

[1] The Struma motorway is also part of the EU Priority Project 7 for the development of the TEN-T along the motorway axis from Igumenitsa/Patra, via Athens and Sofia, to Budapest and covers part of the Trans European corridor IV.

Figure 7-1: Struma Motorway location and lots



Source: Road Infrastructure Agency

The major **objectives** of the project are:

- increase employment and generation of economic growth by providing efficient access and improved connectivity within Bulgaria and across its borders;
- improve social and territorial cohesion;
- improve road safety;
- reduce travel time for cross border and intercity traffic;
- support the goals of reducing emissions;
- improve TEN-T Network and the future interconnectivity of the European road infrastructure, part of which is Struma Motorway.

The **project promoter** is the Road Infrastructure Agency (i.e., RIA).

Technical description

Lot 3.2 from Krupnik to Kresna is approximately 21 km long. The section runs through a challenging mountainous terrain and is dominated by a tunnelled route in the Kresna gorge, for a total length of approximately 15,5 km.

With a view to finding an adequate solution to the above addressed issues, many studies have been conducted and well over ten alternatives for the Kresna gorge area have been developed. These alternatives can be summarised in **three groups**.

1. The alternatives through the gorge entail the construction of the lot in the most natural way. Physically, the gorge is the path of least resistance on the North-South direction. For this reason, most of the alignments explored the possibilities of passing through the gorge according to motorway standards (i.e., transversal section 25 m wide − instead of 29 m − and design speed of 100 km/h (i.e., lower than the usual 120 km/h)).
2. Alternatives on the sides of the gorge explored some alignment options passing on the west side with tunnels and viaducts. They were also designed according to motorway standards[2].
3. Long tunnel alternative with the same layout as one of the alternatives passing west of the gorge.

Most of the alternatives were dismissed as unacceptable with the EIA Decision of 2008. The same decision stated that the **long tunnel alternative** was the only acceptable for the Kresna gorge.

Since 2011, the following new alternatives have been introduced:

- "Do Minimum", involving minor improvements of the existing road and taking into account the highly environmental sensitive nature of the environment.
- "Long Dual Tunnel" represents the preliminary design for Lot 3.2, as developed in years 2013-2015. It was based on the approved EIA and the development of the original idea of a long tunnel in the Kresna gorge. The alternative features a 15,4 km tunnel which is the result of joining two tunnels of 2 km and 13,3 km long.
- "Long Single Tunnel (with unidirectional traffic)" is a variation of the Long Dual Tunnel alternative, with one tube only. The traffic travelling to North was planned to use the existing road, while the traffic going South would use the tunnel.
- "Long Single Tunnel (with bidirectional traffic)" foresees that, instead of building two tunnel tubes, only one tube would be constructed to accommodate bidirectional traffic. Approaching the capacity, a second tube would be built.
- "Dual Carriageway" alignment was conceived with one carriageway closely following the existing road through the gorge, straightening the alignment in some sections, and the other carriageway developing independently with tunnels and viaducts (the total length of the tunnels is 2,9 km and the total length of bridges is about 4 km). The rationale behind was to minimise the footprint and thus reduce impacts on the habitats.
- "Staged Dual Carriageway" alternative is similar to the Dual Carriageway, except that the existing road would not be upgraded but only rehabilitated/reconstructed where appropriate and a second new carriageway would be constructed next to it.
- "Western Alternative", developed in 2015 as part of the EIA procedure, on the west side of Kresna gorge.

The technical characteristics for each of the alternatives is illustrated in Table 7-1.

[2] Two alignment options have been proposed by NGOs and explored the possibility to pass on the East side of the gorge.

Table 7-1: Technical characteristics of the project alternatives of the Struma Motorway Lot 3.2

Technical Indicators	Do Minimum	Long dual tunnel	Long single tunnel - unidirectional	Long single tunnel - bidirectional	Dual carriag.	Staged dual carriag.	Western alternat.
Carriag. width [m]	10,5	29	29/10,5	29	20	20	29
Design speed [Km/h]	68,2	140	60/140	140	80/100	80/100	120
Free-flow speed	60	87,4	77,8	87,4	98,8	85,6	92
Length [km]	23,16	20,42	20,42	20,42	23,79	23,79	24,2
Maximum gradient	4%	2%	2%	2%	5%	5%	4,5%
Number of bridges	2	11	11	11	24	16	8
Total length of bridges [km]	0,5	1,37	1,37	1,37	7,1	2,78	2,01
Number of tunnels	2	1	1	1	7	25	4
Total length of tunnels [km]	0,2	15,36	15,36	15,36	2,9	5,09	10,3

Source: NCSIP

The **costs estimation elaborated** in 2016 for each alternative are summarised in Table 7-2. In 2017, according to advancements of the project design for Lot 3.2 the project costs will be further updated.

Table 7-2: Investment and maintenance costs of the alternatives of the Struma Motorway Lot 3.2 [€ million net of VAT]

Cost item	Do Minimum	Long dual tunnel	Long single tunnel - unidirectional	Long single tunnel - bidirectional	Dual carriag.	Staged dual carriag.	Western alternat.
Investment	39	812	728	701	283	264	619
Operating and maintenance	0,18	4,64	2,63	2,63	0,97	1,37	3,43

Source: NCSIP

Project implementation

Lot 3 has not been completed yet[3]. With regards to the progress on the preparation of Lot 3.2, in 2000 the engineering company Patproject was tasked to find and research alternative variants to those already existing in the region of Kresna gorge and the town of Kresna.

The company prepared the **feasibility study** of Lot 3.2 (i.e., Struma - Eastern options). A design was presented for a road with two carriageways, a transversal section 10,5 m wide and design speed of 80 km/h.

The RIA initiated public procedure for road section design through Kresna Gorge in November 2016. The purpose of the competition procedure is to obtain improved conceptual design, detailed geodetic mapping and engineering and geological survey.

The design elaborated for Lot 3.2 will be used as reference to award the detailed design and construction of the left carriageway of the Struma Motorway in the sections between Krupnik and Kresna, and Kresna bypass-part of the right carriageway.

The received proposals are expected to be evaluated in early April 2017. In the best case, the construction of this section of the highway may start in 2019.

[3] In 2015, the contract agreements for construction and supervision for Lot 3.1 and Lot 3.3 were signed. Lot 1 is operating and Lot 2 and 4 are currently in final stage of completion.

Transport demand

In 2014 NCSIP commissioned[4] the update of the existing traffic forecasts and cost-benefit analysis of the project and prepared an application for obtaining funding under OPTTI. The updated analysis and application form were developed in accordance with the requirements and guidelines for the new programming period.

The study produced a traffic model and forecast. The results from the updated traffic forecast model show a reduction of the traffic that was envisaged in the previous traffic study in 2011. Detailed information has not been made available to the Consultant.

Financial analysis

The Struma Motorway is a toll-free road thus the financial profitability analysis has not been developed.

The project "Struma Motorway, Lot 1, 2 and 4" also includes the **preparation of Lot 3** and is financed under the OPTTI 2007-2013[5]. In June 2013, a contract for grant assistance was signed and financing an amount of € 3,98 million (i.e., BGN[6] 7.776.928).

As the regards the **construction of Lot 3**, this is financed as a priority project under the OPTTI 2014-2020[7]. In September 2015, a grant was allocated to NCSIP for the implementation of the project. The project will be developed under the Priority Axis 2 and financed through the Cohesion Fund.

Economic analysis

Several economic analyses have been carried out since 2011. The first economic analysis was undertaken in 2011 by AECOM to support the application for funding of Lots 1, 2 and 4. The analysis was developed according to the EC guidelines of 2008. The project was justified as a whole and Lot 3 was included in the analysis.

The results of the analysis for Lots 1, 2 and 4 were positive showing an ENPV of € 911 million, an EIRR of 27% and B/C ratio equal to 5,86. Including Lot 3 and the Long Dual Tunnel alternative for Lot 3.2, the economic performance decreased to an **ENPV € 313 million, an EIRR of 8% and B/C ratio of 1,39**. The ENPV decrease was mainly due to the high costs for the construction of the tunnel. This meant that the project remained feasible but only with a small margin.

In 2014 NCSIP appointed a consultant to update the traffic forecast and the economic analysis. The updated CBA used the methodology based on the EC guidelines of 2014 (EC, 2014g).

The update of the input parameters involved (i) key macroeconomic indicators (i.e., GDP growth, inflation, etc.), (ii) the social discount rates, (iii) the implementation programme (i.e., based on up-to-date procurement and construction plans), (iv) investment costs estimates, (v) operation and maintenance costs (including operation and maintenance of the Kresna tunnel) and (vi) value of time. The updated economic analyses also included the impact of the external costs (i.e., air pollution, climate change, noise) estimated according to the Handbook on estimation of external costs in the transport sector (EC, 2014g).

The results of this updated analysis for all lots (with Kresna tunnel) showed a negative performance, ending with an **ENPV equal to € -239 million, an EIRR equal to 3,46% and a B/C equal to 0,79**. The results showed that a project including a long tunnel, as part of Lot 3.2, is economically unfeasible.

---

4 To the Joint Venture ANISA, ITK and PPM.

5 Project 161PO004-2.0.01-0019 by means of Cohesion Fund.

6 Since 2015 the exchange rate of BGN (Bulgarian Leva) to Euro is fixed at the rate of 1.95583 BGN = 1 €.

7 Project BG16M1OP001-2.001-0001 Struma Motorway Lot 3.1, 3.3 and Tunnel Zheleznitsa.

Given these results, a decision was taken to carry out simplified economic analysis for all the alternatives[8]. In 2015, JASPERS accepted this model, but the report finalised in 2015 is not available[9].

The economic performance indicators for each of the major alternatives are reported in Table 7-3.

Table 7-3: Economic indicators of the Struma Motorway Lot 3.2

Economic Indicators	Do Minimum	Long dual tunnel	Long single tunnel - unidirectional	Long single tunnel - bidirectional	Dual carriag.	Staged dual carriag.	Western alternat.
ENPV [€ million]	224,14	-238,97	-190,2	-163,93	88,78	95,72	-116,99
EIRR (%)	7,19	3,46	3,74	3,89	5,75	5,82	4,17
B/C ratio	1,37	0,79	0,82	0,84	1,12	1,13	0,88

Source: NCSIP

The results of the updated economic analyses show that the Long Dual Tunnel (EIA Approved) alternative for Lot 3.2, which was justified as part of the AECOM 2011 CBA, is no longer feasible. The results indicate that, apart from the do-minimum alternative, the Dual Carriageway and Staged Dual Carriageway alternatives are the only ones economically feasible.

With respect to the breakdown of the benefits, the alternatives Dual Carriageway and Staged Dual Carriageway alternatives show an incidence, as follows:

- Value of Time 65,78%[10];
- Vehicle Operating Costs 0,15%;
- Value of Accidents 10,19%[11];
- Air pollution 7,94%;
- Climate changes 6,17%;
- Noise 9,76%.

Finally, the Multi Criteria Analysis finalised in 2016, suggested that the **Dual Carriageway alternative** would be the best option, closely followed by the Staged Dual Carriageway alternative.

Environmental analysis

The alignment of Lot 3 crosses several **Natura 2000** sites as well as the **bio-corridors** connecting them. The key sites are:

- Habitats site “Oranovski Gorge-Leshko” located in Lot 3.1;
- Habitats site “Kresna-Ilindentsi” situated in Lots 3.2 and 3.3;
- Habitats site “Ograzdhen-Maleshevo” located in Lot 3.3;
- Birds site “Kresna” or “Kresna Gorge” situated in Lots 3.2 and 3.3;
- Birds site “Rupite” located in Lot 3.3.

The Terms of Reference for the determination of the scope and contents of the EIA report and compatibility assessment have been developed. The documents were sent to the Ministry of

[8] This economic analysis relied on the developed by the Joint Venture ANISA, ITK and PPM.

[9] The results are gathered from the “Struma Motorway – MCA – Report” (2016).

[10] The total estimated value of time savings is equal to € 923 million for passenger cars and € 298 million for freight (extending the analysis to 2052).

[11] For instance, the dual carriageway option is expected to reduce the fatal accidents by 152 and the accidents with injuries by 881 (extending the analysis to 2052).

Environment and Water, the Ministry of Health and to all the stakeholders. The updated EIA is expected to be issued after the completion of Lot 3.2 conceptual design, currently foreseen for late 2017.

Safety levels

The construction of the motorway section is expected **to improve safety levels**. The analysis of the existing situation shows two main issues that need to be addressed, notably:

- the frequency and severity of traffic accidents, along the existing road E79 in the Kresna gorge, is one of the highest in the country. It is critical to improve traffic safety and do that as quickly as possible.
- in Kresna, the existing road passes through the town resulting in numerous safety problems.

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