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DESIGNERS, PARTICIPANTS AND DOCUMENT STATUS

Role	Information
Designer - conceptual design	Savo Lalović, BSc Civil Engineering
Concept lead	MARVEL d.o.o. East Sarajevo
Surveying	Marko Vasković, BSc Geodetic Engineering
Surveying	Jelena Sladoje, BSc Geodetic Engineering
Surveying organisation	M1 d.o.o. East Sarajevo
Analytical and documentation support	OpenAI - ChatGPT, GPT-5.6 Sol
Edition	East Sarajevo, September 2026

Route of the current scope: Krupac - Sijerca (Y) - Kalinovik - Ulog - Morine - Nevesinje - Stepen; Sijerca (Y) - Miljevina - Brod na Drini / Foča interchange (second Y).

1. STATUS, OBJECTIVE AND METHODOLOGY

The subject of the study is a conceptual Y corridor connecting East Sarajevo with Kalinovik, Ulog, Nevesinje and Stepen, with a second development branch toward Miljevina and Brod na Drini.

The document consolidates the earlier geodetic/KML source materials, adopted technical corrections, structures, junctions, control elevations and investment assumptions into one updated whole.

The methodology uses KML/KMZ lengths from M1 d.o.o. East Sarajevo, control elevation data, the adopted sequence of structures and planning unit costs. Average gradients are control geometric indicators between characteristic points and do not represent the final designed vertical alignment.

2. DESIGNERS, PARTICIPANTS AND SOURCE MATERIALS

MARVEL d.o.o. East Sarajevo is the lead entity for the conceptual concept. The conceptual design designer is Savo Lalović, BSc Civil Engineering. Surveying source materials and route setting are provided by M1 d.o.o. East Sarajevo, with Marko Vasković and Jelena Sladoje, BSc Geodetic Engineering. OpenAI - ChatGPT, GPT-5.6 Sol provides analytical and documentation support without formal design responsibility. The basis for further work consists of the original KML/KMZ routes, surveying source materials, future DTM and actual longitudinal profiles, hydrological source materials and geological-geotechnical investigations.

3. FINALLY ADOPTED SCOPE AND ROUTE SEQUENCE

Route part	Sequence
Common route	Krupac - Presjenica - Bijela Rijeka Bridge - Ilovice - Trnovo (interchange and bridge over the Željeznica River) - Rogoj Tunnel - Dobro Polje (Bistrice Bridge) - Sijerka Y
Right branch	Sijerka - Kalinovik interchange - Ulog - Ulog Bridge over the Neretva - about 500 m of open route - Morine Tunnel - Gornja Bijenja - Nevesinje interchange - Stepen
Left branch of this phase	Sijerka - Miljevina - Govza Bridge - Miljevina interchange - Brod na Drini - Foča interchange / second Y; termination before crossing the Drina

Boundary of the current investment scope: Foča interchange / second Y at Brod na Drini, before crossing the river.

4. BASIC TECHNICAL PARAMETERS

Element	Motorway - reference option	Expressway - comparative option
Design speed	Vr = 130 km/h	to be defined by the design brief
Cross-section	full dual carriageway 2x2	more rational profile; possible phasing
Access	fully controlled	controlled; rationalisation according to the study
Interchanges	fully grade-separated	grade-separated; possible rationalisation
Longitudinal gradient	target about 3% where terrain permits	optimise according to standard and terrain

The expressway design speed has not been fixed at this stage. Long tunnels, major bridges, interchanges and safety systems are designed in accordance with applicable regulations and investigation results.

5. LENGTHS AND CONTROL ELEVATIONS

Section	Working length	Control data
Krupac - Trnovo	18.60 km	about 540 -> 825 m
Rogoj - Dobro Polje, KML sector	4.59 km	portal elevations about 875 / 980 m
Dobro Polje - Sijerca	12.17 km	980 -> 1,138 m
Common Krupac - Sijerca	about 35.36 km	counted only once
Sijerca - Ulog	about 24.59 km	Sijerca 1,138 m; Ulog/Neretva about 650 m
Morine Tunnel	about 13.7 km	650 -> 929 m; control about +2.04%
G. Bijenja - Nevesinje - Stepen	about 50.7 km	Stepen about 755 m
Right branch Sijerca - Stepen	about 89.7 km	working version
Sijerca - Miljevina - Brod	about 16.35 km	to the second Y before the Drina
Unique network of this phase	about 141.4 km	without duplicating the common route

Earlier KML versions contain minor differences in lengths. For final stationing, one verified axis must be adopted. Stationing begins at Krupac 0+000.

6. ANALYSIS 1 - KRUPAC - TRNOVO

Basic data: 18.60 km; control elevations approximately 540-825 m; average control gradient about +1.53%.

Key elements: Krupac 0+000; Presjenica; Bijela Rijeka Bridge; Ilovice; Trnovo interchange; bridge over the Željeznica River.

Design assessment: The route must cross the Bijela Rijeka before its confluence with the Željeznica, thereby avoiding two unnecessary crossings of the Željeznica. At Trnovo, the Željeznica is crossed by a bridge and an interchange is formed. The DTM should confirm any shorter tunnels.

7. ANALYSIS 2 - ROGOJ - DOBRO POLJE

Basic data: KML sector about 4.59 km; control portal elevations 875 and 980 m.

Key elements: Rogoj Tunnel and approach sections.

Design assessment: The previously mentioned length of 2.5 km gives an unfavourable elevation relationship. At the conceptual level, a tunnel in the order of 4-5 km should be checked in order to target a longitudinal gradient of about 3%, subject to final geology and vertical alignment.

8. ANALYSIS 3 - DOBRO POLJE - SIJERCA Y

Basic data: 12.17 km; elevations approximately 980-1,138 m; control average about +1.30%.

Key elements: The bridge over the Bistrica is located in Dobro Polje; Sijerca Y follows.

Design assessment: After the bridge in the Dobro Polje zone, the route reaches the key Sijerca Y junction. The position of the structure and approaches should be confirmed by surveying and hydrological analysis.

9. ANALYSIS 4 - SIJERCA - KALINOVIK - ULOG

Basic data: about 24.59 km; Sijerca 1,138 m; Ulog/Neretva about 650 m.

Key elements: Kalinovik interchange; Ulog; Ulog Bridge over the Neretva; about 500 m of open route to the Morine portal.

Design assessment: Kalinovik is a separate interchange between Sijerca and Ulog. Immediately after the bridge over the Neretva, a short open section follows, and then the portal of the Morine Tunnel.

10. ANALYSIS 5 - MORINE TUNNEL / GORNJA BIJENJA

Basic data: working tunnel length about 13.7 km; entrance zone about 650 m, Gornja Bijenja exit about 929 m.

Key elements: Long Morine Tunnel; portals; safety and electromechanical systems.

Design assessment: The control gradient is about +2.04%. The tunnel is the dominant capital and geotechnical structure of the right branch. Multi-phase geological and hydrogeological investigations, selection of excavation technology, ventilation, evacuation, drainage and logistics are required.

11. ANALYSIS 6 - GORNJA BIJENJA - NEVESINJE - STEPEN

Basic data: working length approximately 50.7 km; Stepen about 755 m.

Key elements: Open route; Nevesinje interchange; local minor structures according to the DTM.

Design assessment: From Gornja Bijenja via Nevesinje to Stepen, an open route without major tunnels and without major bridges has been adopted. Local structures are determined through the detailed profile and alignment plan.

12. ANALYSIS 7 - SIJERCA - MILJEVINA - BROD NA DRINI

Basic data: working length about 16.35 km.

Key elements: Miljevina; Govza Bridge; Miljevina interchange; Brod na Drini; Foča interchange / second Y.

Design assessment: The second Y is located at Brod na Drini before crossing the Drina. The current investment unit ends at that interchange. The descending vertical alignment should be specifically optimised using the actual profile.

13. BRIDGES - CONSOLIDATED OVERVIEW

Bridge	Location	Design focus
Bijela Rijeka	after Presjenica, before Ilovice	hydrology, route/watercourse cross-section, foundations
Željeznica	Trnovo	integration with Trnovo interchange and vertical alignment
Bistrica	in Dobro Polje, before Sijerca	hydrology and smooth approach to the Y junction
Ulog / Neretva	Ulog	bridge - open route - Morine portal interface
Govza	Miljevina	bridge within local geometry and interchange zone

For each major bridge, at least two structural alternatives should be prepared in the next phase, including spans, pier heights, foundations, construction technology, access roads and cost estimate.

14. TUNNELS

Rogoj Tunnel. The final length should be determined after the actual longitudinal profile and geological investigations. The working engineering estimate indicates that the length should exceed the old figure of 2.5 km if a longitudinal gradient of approximately up to 3% is to be maintained.

Morine Tunnel. Working length about 13.7 km. Key elements are geology and hydrogeology, portals, ventilation, evacuation, fire protection, drainage, power supply, communications, operating systems and excavation logistics.

15. INTERCHANGES AND JUNCTIONS

The adopted junctions are: Trnovo interchange; Sijerca Y; Kalinovik interchange; Nevesinje interchange; Miljevina interchange; Foča interchange / second Y at Brod na Drini. The Foča interchange is the terminal point of the left branch of the current phase and is located before crossing the Drina.

16. TRAFFIC AND FUNCTIONAL ANALYSIS

The corridor has a network logic with the common Krupac-Sijerca route and two branches. The common route is the priority because it serves both development directions. The right branch creates a connection toward Kalinovik, Ulog, Nevesinje and Stepen. The left branch to Brod na Drini forms a second strategic Y junction and leaves open the possibility of future routes. The traffic study should determine AADT, vehicle composition, traffic-flow distribution, seasonal effects, the function of freight traffic, development scenarios and the justification of full motorway standard versus an expressway.

17. GEOLOGY, HYDROLOGY, ENVIRONMENT AND SAFETY

The greatest geological-geotechnical risk within the current scope is the Morine Tunnel, followed by Rogoj, high cuts and potentially unstable slopes. Hydrology must confirm the exact cross-sections of the Bijela Rijeka, Željeznica, Bistrica, Neretva and Govza, design floods and foundation conditions.

The environmental analysis should cover watercourses, forests, settlements, agricultural land, noise, air quality, fauna, disposal of excavated material and protection of water sources. Safety is checked through RSA and specific tunnel analyses.

18. INVESTMENT ESTIMATE OF THE CURRENT SCOPE

Unit	Low	Realistic	High
Krupac - Sijerca Y	~0.64	~0.96	~1.26
Sijerca - Kalinovik - Ulog - Morine - Nevesinje - Stepen	~1.97	~2.81	~3.73
Sijerca - Miljevina - Brod / Foča interchange	~0.25	~0.37*	~0.50
TOTAL unique network	~2.86	~4.14*	~5.49

* billion KM, excluding VAT. Planning-level conceptual range. The left branch must be recalculated separately by bill of quantities so that the Foča interchange is explicitly included.

For presentation purposes, an order of magnitude of about KM 4.1 billion excluding VAT may be used, but not as a final contractual or design estimate.

19. MOTORWAY AND EXPRESSWAY - PRICE COMPARISON

The motorway is the reference full-standard option with $V_r = 130$ km/h and fully controlled access. The expressway is considered in the same corridor, with a more rational cross-section, interchanges and open sections. For long tunnels, the price difference is smaller because geology, safety systems, ventilation and equipment remain dominant.

Indicative planning comparison for the unique network within the current scope (billion KM, excluding VAT):

Option	Low	Realistic	High
Motorway	~2.86	~4.14	~5.49
Expressway*	~2.50	~3.55	~4.75
Difference / saving	~0.36	~0.59	~0.74

* Working planning estimate for comparison of alternatives. The saving is not applied as one fixed percentage to the entire route; it is greatest on open sections, cross-section, interchanges and expropriation, and smaller for long tunnels. The final comparison must be confirmed by separate CAPEX/OPEX bills of quantities for both alternatives.

20. PHASED IMPLEMENTATION

Phase I: Krupac - Sijerca (common route).

Phase II: Sijerca - Foča (via Miljevinina and Brod na Drini, to the Foča interchange / second Y before the Drina).

Phase III: Sijerca - Stepen (via Kalinovik, Ulog, Morine Tunnel, Gornja Bijenja and Nevesinje).

The final implementation sequence is to be confirmed by the traffic study, economic analysis and financing possibilities.

21. FUTURE DEVELOPMENT BEYOND THE CURRENT SCOPE

Possible future development beyond Brod na Drini is not the subject of this study or of the current investment estimate. The right route from Stepen provides the possibility of motorway development toward Trebinje, Mostar and the Ionian-Adriatic corridor, while the left route to Foča provides the possibility of connections with Montenegro, Goražde, Višegrad and Serbia.

22. PROGRAMME OF SUBSEQUENT DESIGN ACTIVITIES

1. Verify one unique KML/KMZ axis and stationing from Krupac 0+000.
2. Prepare a DTM and actual longitudinal profiles of all sections within the current scope.
3. Initiate geological-geotechnical and hydrogeological investigations of Rogoj and Morine.
4. Carry out hydrological-hydraulic analyses of all adopted watercourse crossings.
5. Prepare conceptual designs of bridges and tunnels with structural and construction-technology alternatives.
6. Develop the geometry of all interchanges, especially Sijerca Y and Foča / second Y.
7. Prepare a traffic study and traffic-flow forecast.
8. Prepare an environmental and spatial-planning analysis.
9. Prepare separate bills of quantities and CAPEX/OPEX for the motorway and expressway.
10. Prepare a feasibility study and CBA.
11. After adoption of the alternative, proceed with conceptual/main design and independent review/RSA.

23. CONCLUSION

The updated concept of the East Sarajevo-Herzegovina Motorway forms a functional network with the common Krupac-Sijerca route and two branches. The right branch runs via Kalinovik, Ulog, the Morine Tunnel and Nevesinje to Stepen. The left branch of the current phase runs via Miljevina and Govza to Brod na Drini, where it terminates at the Foča interchange / second Y before crossing the Drina.

The key capital structures within the current scope are the Rogoj and Morine tunnels, the Bijela Rijeka, Željeznica, Bistrica, Ulog/Neretva and Govza bridges, and the Trnovo, Sijerca, Kalinovik, Nevesinje, Miljevina and Foča/Brod interchanges.

The unique network within the current scope is approximately 141.4 km long. The working realistic investment order of magnitude is about KM 4.1 billion excluding VAT, subject to a mandatory new itemised check of the Foča interchange.