



Technical Assistance to Connectivity in the Western Balkans EuropeAid/13785/IH/SER/MULTI

BOSNIA & HERZEGOVINA

Consultancy services for preparation of a set of tunnel and fire safety studies for the Prenj Tunnel in Corridor Vc in Bosnia and Herzegovina

Partners:

- European Bank for Reconstruction and Development (EBRD)
- European Investment Bank (EIB)
- JP Autoceste Federacije Bosne i Hercegovine (JPAC)

Budget of Technical Assistance:

- Euro 310,000

EU contribution¹:

- As above (100%)

Technical Assistance provided by:

- CONNECTA (Technical Assistance to Connectivity in the Western Balkans)

Bosnia and Herzegovina signed a loan agreement with the European Bank for Reconstruction and Development (EBRD) and the European Investment Bank (EIB) to finance priority sections of the motorway on Pan European Corridor Vc through Bosnia and Herzegovina. The Federation of Bosnia and Herzegovina intends to apply part of the proceeds of this loan towards the cost of civil works and consulting services for the motorway section Ovčari – Tunnel Prenj – Mostar North, sub-section Tunnel Prenj.



The Prenj tunnel is located in Bosnia and Herzegovina, within the Herzegovina - Neretva Canton. It passes through the eponymous mountain massif Prenj in the north-western part of East Herzegovina. It will constitute an integral part of the Ovčari - Mostar north sub-section of Corridor Vc. According to the conceptual design, the length of the entire Prenj tunnel will be 10.165 km, making it the longest tunnel in Bosnia and Herzegovina and the wider region and one of the longest road tunnels in Europe.

The public company, Motorways of the Federation of Bosnia and Herzegovina Ltd. Mostar (JPAC), is responsible for the project implementation on behalf of the Government of the Federation of Bosnia and Herzegovina. JPAC had a financial agreement with EBRD for implementation of consultant services in the preparation of the studies for tunnel and fire safety within this motorway section.

The **overall objective** was to prepare a set of studies for tunnel safety and fire safety of the Prenj tunnel.

The studies aimed to analyse different technical solutions for the execution of the tunnel and the level of associated equipment required with respect to fire safety. At the same time, they aimed to evaluate the safety aspects and some technical aspects of the tunnel.

Results achieved by the TA:

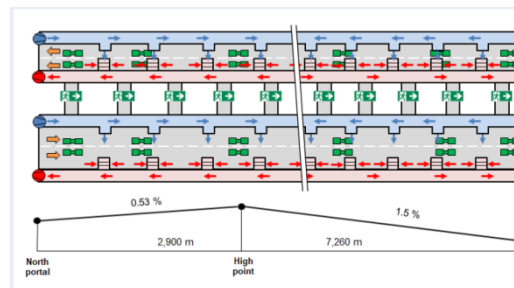
The studies in terms of tunnel safety and fire safety included the following:

- Quantitative Risk Analysis Study (QRA);
- Ventilation Study;
- Risk Assessment Study on Dangerous Goods Transport; and
- Update of the existing (2005) guidelines for the design of tunnels and tunnel equipment and related technical specifications, aligned with the **EU Directive 2004/54/EC** (on minimum safety requirements for tunnels in the Trans-European Road Network) and **EU Directive 2008/96/EC** (on Road Infrastructure Safety Management).

VENTILATION CONCEPTS – BIDIRECTIONAL TUBE

#	Ventilation system	Emergency exits	Schematic drawing	Comments
1	Longitudinal ventilation system	Cross passages to parallel rescue tube		
2	Full-transverse ventilation system in traffic tube	Cross passages to parallel rescue tube		
3	Semi-transverse ventilation system in traffic tube	Cross passages to parallel rescue tube		

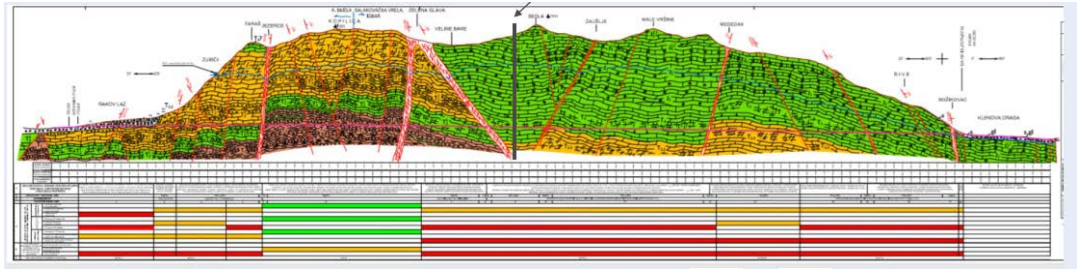
Ventilation concepts – Bidirectional tube



Full-transverse ventilation system with ventilation shaft

Transport

¹ EU contribution concerns only Technical Assistance services for project development



Possible position of ventilation shaft

Key recommendations - further actions:

- Transpose respective EU Directives and endorse relevant EU and best global practices;
- Ventilation system has been defined; cost estimation of the next design stage should be done and should now be more accurate; and
- Update of the existing (2005) guidelines for the design of tunnels and tunnel equipment and related technical specifications should form the first phase of a comprehensive update of the overall guidelines that should follow.

Key conclusions:

- The Quantitative Risk Analysis has defined:

-The overall risk within the tunnel (personal risk for tunnel users) based on a quantitative approach;

-Effects of selected fire scenarios on characteristic tunnel parameters, with a special focus on how the operation of different ventilation systems analysed in the Ventilation Study affects the safety level of the tunnel;

-Recognised risk criteria;

-Additional measures for mitigating risk (as needed) in order to compensate for the defects and the assessment of their effect on risk in the Risk Analysis Study;

-Confirmation of the selected ventilation system proposed in the Ventilation Study, together with potentially required additional measures for risk mitigation; and

-Effect of the tunnel phased construction on the installed equipment in Phase 1 of construction, with the assessment of justifiability of such a construction approach.

- The Ventilation Study has defined or completed:

-Comparative review of the international technical regulations in the field of road tunnel ventilation, with a special focus on the regulations covering long tunnels of comparable structural configuration as the Prenj tunnel;

-The analysis of selected ventilation systems under regular working conditions and fire incident conditions and the identification of operative strategies for characteristic usage conditions;

-Selected ventilation system solutions from the aspect of safety in the event of fire and operational efficiency; and

-The recommendation on the use of the ventilation system based on the performed evaluation.

- The Risk Assessment Study on Dangerous Goods Transport, has defined or undertaken:

-A detailed overview of structures on that route (viaducts, bridges, overpasses, underpasses, intersections), with a special focus on the tunnels;

-The identification of characteristic scenarios for transporting dangerous goods, according to the DG QRAM methodology;

-The performance of a multi-phase procedure of risk analysis; and

-Defined risk level for all characteristic scenarios of transporting dangerous goods, considering the anticipated traffic loads based on AADT.

Benefits expected due to Technical Assistance:

- These pioneering Tunnel Studies in BiH to be used as best practice example for future studies;
- Endorsement of the studies as a part of the decision-making process at the planning stage; and
- Use of EU best practices and updated tunnel guidelines.

Impacts anticipated:

- Better understanding of the effect of long tunnels and dangerous goods transport;
- Improved knowledge of possible ventilation concepts;
- Minimising risks regarding tunnel safety; and
- Improvement of safety performance indicators.