# TERMS OF REFERENCE

## for the preparation of the Spatial Plan, Feasibility Study with Preliminary Design, Environmental Impact Assessment Study and Environmental and Social Impact Assessment for the Reconstruction and Modernization of the Ruma – Šabac – Donja Borina Junction – State Border Railway Line

Belgrade, April 09, 2025

# COMMON ABBREVIATIONS AND DEFINED TERMS

| Abbreviation | Meaning |
|---|---|
| AFD | Agence Francaise de Développement |
| AGC | European Agreement on Main International Railway Lines |
| BoQ | Bill of Quantities |
| CBA | Cost-benefit analysis |
| Client | Ministry of Construction, Transport and Infrastructure through the Project Implementation Unit |
| Consultant | Specialized consultant (Company) which should carry out the scope of work detailed in this ToR |
| CWR | Continuous welded rail |
| EHSG | Environmental, Health and Safety Guidelines |
| EIA | Environmental Impact Assessment |
| ESF | Environmental and Social Framework |
| ESIA | Environmental and Social Impact Assessment |
| ESCP | Environmental and Social Community Plan |
| ESMP | Environmental and Social Management Plan |
| ERTMS | European Railway Traffic Management System |
| FS | Feasibility study |
| GSM-R | Global System for Mobile Communications – Railway |
| IBRD | International Bank for Reconstruction and Development |
| IPF | Investment Project Financing |
| JDC | Operation Control Centre |
| JSC | Join Stock Company |
| MoCTI | Ministry of Construction, Transport, and Infrastructure |
| MPA | Multi-Phase Programmatic Approach |
| OCL | Overhead contact line |
| PD | Preliminary Design |
| PIU | Project Implementation Unit |
| PR | Performance Requirement |
| Program | Serbia Railway Sector Modernization (SRSM) |
| Project | Reconstruction and Modernization of the Ruma – Šabac – Donja Borina Junction – State border Railway Line |
| QCBS | Quality-and Cost-Based Selection |
| RD | Radio dispatching |
| RLC | Rail level crossing |
| RS | Republic of Serbia |
| SRI | Serbian Railways Infrastructure |
| SRMS | Serbia Railway Sector Modernization |
| SS | Signalling and Safety |
| TEN-T | Trans-European Networks - Transport |
| ToR | Terms of Reference |
| TS | Traction substations |

| **Abbreviation** | **Meaning** |
|---|---|
| TSI | Technical Specification for Interoperability |
| UIC | The International Union of Railways (French: Union Internationale des Chemins) |
| WB | World Bank |

# 1. INTRODUCTION

## 1.1. Background

For the purpose of financing Serbia Railway Sector Modernization (SRSM) Program (the "Program"), Phase 1 of the Multi-phase Programmatic Approach (MPA), International Bank for Reconstruction and Development (IBRD) and the Agence Francaise de Développement (AFD), jointly, granted to the Republic of Serbia EUR 102 million loan to support enhancing the efficiency and safety of existing railway assets and improving governance and institutional capacity of the railway sector. The Program is managed by the Ministry of Construction, Transport and Infrastructure (MoCTI) in the role of the Client, through the Project Implementation Unit (PIU) and with Serbian Railways Infrastructure (SRI) as Beneficiary.

Phase 1 of the Program includes the preparation of spatial and technical documentation (Spatial Planning and Design Documentation) for the reconstruction and modernization of the **railway section Ruma – Šabac – Donja Borina Junction – State border in total length of approx. 109,5 km (the "Project")**. This regional railway line connects rail corridors in Serbia and Bosnia and Hercegovina. The rail line is presented on Figure 1. A full description of the Project and anticipated technical requirements is included in Section 1.6.

*Figure 1. Geografic position of the railway section Ruma - Sabac – Donja Borina Junction - State border on railway network at Republic of Serbia*


This Terms of Reference (ToR) document relates to the preparation of the necessary Spatial Planning and Technical Documentation for the reconstruction and modernization of this railway line and its service points and shall result in the establishment of enhanced railway line parameters and increase in reliability, aiming to increase the railway line safety, capacity and quality as well as the competitiveness of rail transport.

The Client intends to procure the services of a specialized consultant (The "Consultant") to carry out the scope of work detailed in this ToR.

## 1.2. World Bank Environmental and Social Framework (ESF) for infrastructure interventions

The Environmental and Social Framework (ESF) of the World Bank is designed to help both the Bank and Borrowers manage environmental and social risks more effectively, thereby improving development outcomes. A key aspect of the ESF is the Borrower's commitment to adhering to the framework's standards and requirements. Borrower's commitment is by means of contractual obligation transferred to the Contractor, in case of this ToR – to the Consultant.

Borrowers are required to assess and manage environmental and social risks associated with their projects. This involves a thorough review of the country's policy, legal, and institutional frameworks, as well as the technical and institutional capacity of the Borrower and relevant agencies. The ESF consists of the World Bank E&S

Policy and E&S Standards (ESSs) and mandatory use of World Bank Environmental Health and Safety Guidelines (WB EHSG) as well as Good International Industry Practice (GIIP). In summary, the Borrower's and Consultant's commitment under the ESF involves a comprehensive approach to managing environmental and social risks, supported by capacity building and adherence to detailed procedural requirements.

Since this Terms of Reference (ToR) is part of the SRMS Program activities funded by the World Bank, all activities and outputs under this ToR must align with the requirements and standards established by the World Bank Environmental and Social Framework (WB ESF). The sustainability of these activities will also be guided by the SRMS Phase 1 Project's due diligence documents, including the Labor Management Procedure (LMP), Environmental and Social Management Framework (ESMF), project-level Stakeholder Engagement Plan (SEP), and other Resettlement Policy Frameworks (RPF). Consultant's outputs will meet the objectives of material measures and actions to address the potential environmental and social risks and impacts of this project in accordance with the mitigation hierarchy and stay within the set definitions and boundaries. For instance, as per the ESMF (and ESCP), any activities identified as high risk, including specific technical solutions that could have significant downstream impacts, will not be financed through this Project. Further, no new railway tracks that are not described in the Project Description section of this TOR will be evaluated as part of the scope of work of this TOR.

It is the responsibility of the Project Implementation Unit (PIU), which operates under the Ministry of Construction, Transport and Infrastructure (MoCTI), to provide all the aforementioned documents to the Consultant.

## 1.3. General Railways Sector Information

The position of Serbia in the European railway network is such that it forms part of the shortest traffic line between West and South-East Europe and as such is often referred to as a gateway of Europe.

The length of the railway lines in the Republic of Serbia is 3.357,3 km, of which 3.012,2 km are single-track and 345,1 km of double-track railway lines, of which 1.313,3 km are electrified. Railways within the Serbian railway network is categorized as main, regional, local and shunting lines.

Infrastructure modernization is essential to address various cross-cutting performance issues like safety, resilience, inclusion, and digitalization. Decades of low investments, outdated management structures and practices, and neglect of maintenance have led to serious deterioration of the Serbian rail network infrastructure, obsolescence of the rolling stock, and low rail service quality.

The regional railway line No. 211: Ruma - Šabac – Donja Borina Junction – State border is also part of the indicative extension of TEN-T to the Western Balkans Comprehensive Network branded as Route 9A: Novi Grad (Bosnia and Herzegovina) – Banja Luka – Doboj – Tuzla (Bosnia and Herzegovina) – Brcko/Zvornik (Bosnia and Herzegovina) – Loznica – Ruma (Serbia). Having in mind that this railway line is part of the Comprehensive Network and that it connects two main railway corridors X and Vc, the modernization of this line is one of the important goals that should be achieved in order to increase its capacity.

## 1.4. Existing condition of Ruma – Šabac – Donja Borina Junction – State border

The Ruma – Šabac - Donja Borina Junction - border with Bosnia and Herzegovina railway is a single-track, non-electrified railway line with a length of about 109,7 km, which in current condition of railway substructure and superstructure does not meet modern transport requirements.

The railway was constructed between 1901 and 1978. According to the Network Statement for the year 2025, the maximum allowable speed for diesel railcars ranges from 50 to 80 km/h.

According to currently available data, civil structures on the route include 4 tunnels (total length of 420m), 7 concrete bridges (total length of 754m), and 10 steel bridges (total length of 750m). Additionally, there are 71 culverts, 45 slab culverts, and 3 arched culverts, 113 level crossings, and 8 retaining walls.

In 2018, the section from Šabac to Brasina was overhauled in total length of 53 km, which created the conditions for the establishment of regular passenger rail traffic between Šabac and Loznica.

Railway stations are equipped with different station interlocking devices, from electronic to mechanical devices without dependence on signals in the station. There are light and visual signals on rail line. Communication

between stations takes place via copper cables and outdated telephone switchboards, and train traffic is organized in station spacing.

The list of service point on rail line and speeds are listed below:

*Table 1. Parameters of the railway line according to the Timetable for 2025.*

| Chainage | Service point | Type of service point | Maximum permitted speed in km/h |
|---|---|---|---|
| 0+517 | Ruma | Station | 70 (80) |
| 11+344 | Bođanovci | Station | |
| 16+675 | Nikinci | Loading point and halt | |
| 21+344 | Platičevo | Station | |
| 28+900 | Klenak | Halt | |
| 31+373 | Rasputnica 1 | Junction | |
| 31+952 | Rasputnica 2 | Junction | 50 |
| 32+715 | Šabac | Station | |
| 33+695/0+000 | Šabac (end of line) | Station | |
| 1+394 | Rasputnica 3 | Junction | |
| 4+000 | Majur | Halt | 70 (80) |
| 7+725 | Štitar | Passing point | |
| 14+300 | Dublje Mačvansko | Halt | 60 (80) |
| 22+031 | Petlovača | Station | |
| 25+800 | Ribari | Halt | |
| 28+713 | Prnjavor Mačvanski | Station | |
| 33+300 | Podrinsko Novo Selo | Halt | |
| 35+000 | Lešnica | Station | |
| 38+900 | Jadarska Straža | Halt | |
| 45+400 | Lipnica | Halt | |
| 51+396 | Loznica | Station | |
| 53+400 | Loznica Fabrika | Halt | |
| 56+183 | Koviljača | Station | |
| 61+700 | Gornja Koviljača | Halt | |
| 65+354 | Brasina | Station | |
| 67+800 | Donja Borina | Halt | |
| 68+685/0+000 | Rasputnica Donja Borina | Junction | |
| 0+800 | State Border | / | 50 |
| 73+500 | Zvornik | | |
| 75+300 | Zvornik grad (Mali Zvornik) | Station | 30 |

*Figure 2. Track alingement at Šabac triangle and at the end of rail line*

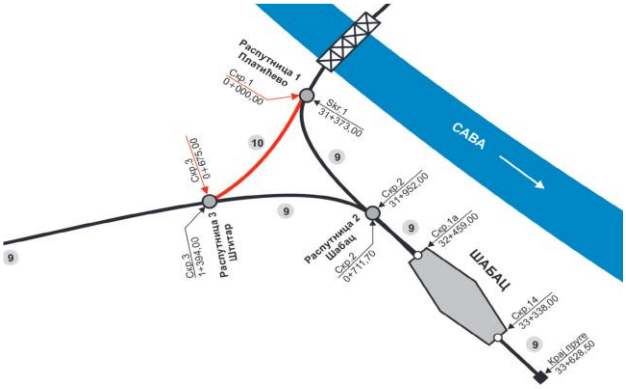
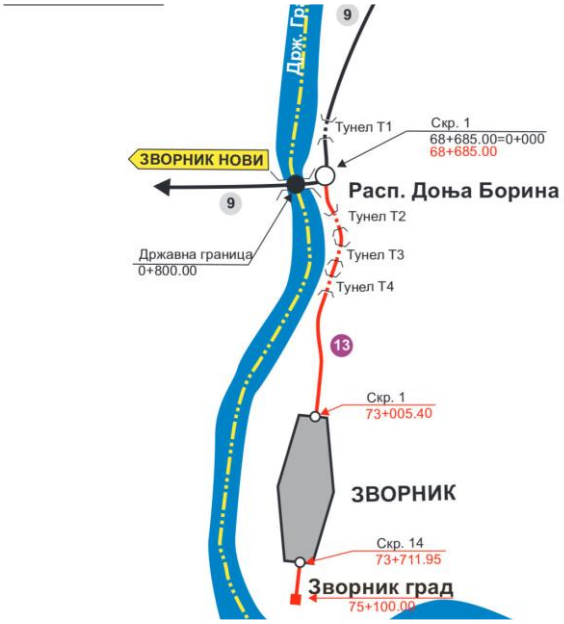



*Figure 3. Track alingement at the end of rail line*




Due to current condition of railway infrastructure, speeds are reduced from the designed ones at maximum speed from 50 km/h up to 80 km/h on some sections.

Railway line section Ruma – Šabac – Donja Borina Junction – State border railway line is open for mixed traffic, for passenger and freight trains.

## 1.5. Documentary basis

The documentary basis for the preparation of technical documentation for the modernization of the railway line is:

- Spatial plan of Republic of Serbia 2021 to 2035 – Draft;
- Regional spatial plan for AP Vojvodina 2021 to 2035 – Draft;
- Law on Railways ("Official Gazette of RS" No. 41/2018 and 62/2023);
- Law on Safety in Railway Traffic ("Official Gazette of RS" No. 41/2018);
- Law on Interoperability of Railway System ("Official Gazette of RS" No. 41/2018and 16/2022 - authentic interpretation);
- Law on Planning and Construction ("Official Gazette of RS", No. 72/221A9, 81/221A9 - corrigendum, 64/2010 - US decision, 24/2011, 121/2012, 42/2013 - US decision, 50/2013 - US decision, 98/2013 -

US decision, 132/2014, 145/2014, 83/2018, 31/2019, 37/2019 - other law, 9/2020 ,52/2021 and 62/2023);

- Rulebook on the content, manner and procedure of preparation and manner of control of technical documentation according to the classes and purposes of the objects ("Official Gazette of RS", No. 96/2023);
- Rulebook on the content, manner and procedure of preparation of spatial and urban planning documents ("Official Gazette of RS", No. 32 of May 3, 2019);
- SRI Network Statement for 2025;
- Rulebook on technical conditions for subsystem infrastructure („Official Gazette of RS“, no. 39/2023);
- Rulebook on amendments to the Rulebook on technical conditions for subsystem infrastructure (“Official Gazette of RS”, No. 17/2024);
- Rulebook on maintenance of railway superstructure and substructure („Official Gazette of RS“, no. 39/2023);
- Rulebook on the technical requirements for signalling and safety devices („Official Gazette of RS“, no. 118/2021);
- Rulebook on the maintenance of signalling and safety devices (“Official Gazette of RS”, No. 136/2020);
- Rulebook on the technical requirements and maintenance of the railway telecommunication network („Official Gazette of RS“, no. 68/2021);
- Rulebook on the technical requirements that must be fulfilled by the energy subsystem („Official Gazette of RS“, no. 6/2020);
- Rulebook on the maintenance of energy subsystem (“Official Gazette of RS”, No. 117/2021)
- Commission Regulation (EU) No. 1299/2014 of November 18, 2014, on the technical specifications for interoperability relating to the "infrastructure" subsystem of the European Union's railway system.
- Commision Regulation (EU) No. 1300/2014 of November 18, 2014, on the technical specifications for interoperability relating to the accessibility of the Union's railway system for persons with disabilities and reduced mobility.
- Commission Regulation (EU) No. 1301/2014 of November 18, 2014, on the technical specifications for interoperability relating to the "energy" subsystem of the Union's railway system.
- Commission Implementing Regulation (EU) 2023/1695 of 10 August 2023 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union and repealing Regulation (EU) 2016/919;
- Commission Regulation (EU) No. 776/2019 of June 16, 2019, amending the technical specifications for interoperability relating to the subsystems INF, CCS, and ENE of the European Union's railway system.
- Law on Environmental Impact Assessment ("Official Gazette of RS", No. 94/24);
- Law on Environmental Protection ("Official Gazette of RS", No. 135/2004 and 36/2009 36/2009 - other law 72/2009 - other law, 43/2011 - decision US, 14/2016, 76/2018, 95/2018 - other law and 95/2018 - other law, 94/2024-other law);
- Rulebook on the content of the Environmental Impact Assessment Study („Official Gazette of RS“, no 69/2005);
- Rulebook on the content and scope of previous works, Pre-feasibility study and Feasibility studies ("Official Gazette of RS", No. 1/2012);
- Rulebook on the Content of Requirements on the Need for Impact Assessment and the Content of the Requirements for Determining the Scope and Content of the Environmental Impact Assessment Study („Official Gazette of the Republic of Serbia“, no 69/2005);
- Law on Expropriation („Official Gazette of the Republic of Serbia“, no 53/1995, „Official Gazette of Federal Republic of Yugoslavia“ no 16/2001 decisions of the Federal Constitutional Court 23/2001 (SUS) и („Official Gazette of the Republic of Serbia“, no 20/2009 и 55/2013 – decision of the Constitutional Court 106/2016 DD– authentic interpretation);

- Existing documentation of "Serbian Railways Infrastructure" JSC on the construction of the railway line, measures and works on maintenance and rehabilitation, the existing condition of the railway line, recorded problems, etc.;
- Data on underground installations of " Serbian Railways Infrastructure " JSC and other relevant infrastructure owners in scope of project;
- Existing documentation for capital repair and rehabilitation works;
- WB Environmental and Social Framework, including relevant E&S Standards, WB EHSG and GIIP;
- Programs Environmental and Social Management Framework (ESMF);
- Programs Environmental and Social Commitment Plan (ESCP);
- Programs Resettlement Policy Framework (RPF);
- All other applicable laws, by-laws, standards and regulations related to the subject of the project, fire protection, regulations related to safety and protection at work.

## 1.6. Project Description and Objectives

Under the scope of Project for the reconstruction and modernization of the Ruma – Šabac – Donja Borina Junction – State border railway line (the "Project") it is anticipated that following requirements will be included:

- Reconstruction and modernization of the single track railway line, starting from the exit switch of Ruma station, triangle near Šabac (from Junction 1 to Junction 3), passing through the Šabac station, the Donja Borina junction and ends at the State Border (0+800 from Donja Borina Junction), and also via branch line reaching end at Zvornik Grad (Mali Zvornik) from km 68+685 to 75+300, including the improvement of alignment elements for speeds of up to 120 km/h and permissible axle load on the railway line of 225 kN and permissible load per linear meter of 80 kN/m (category D4). As the state border is on the bridge over the Drina River, the project will finish at the beginning of the bridge;
- Construction of joint border station Donja Borina with all necessary facilities to accommodate institutions of both countries (railway, border police, customs, phytosanitary and veterinary inspections) that will conduct joint border procedures in one place.
- Reconstruction of tracks and platforms in all service points (stations and halts) along the line according to new station layouts that should be defined based on the forecasted future demand, with the proposal of cancellation of certain halts that should be agreed with the Client;
- Reconstruction, rehabilitation and replacement of bridges and culverts, as needed;
- Construction of fixed electric traction installations (electrification with the 25 kV/50 Hz system);
- Fitting the open track and station tracks capacities with modern signalling and interlocking facilities in stations;
- Digitalization of telecommunications on the entire railway line;
- Increasing the level of protection at level crossings, reconstruction and redesign of existing level crossings and/or potential deleveling of the most critical level crossings on the railway line as needed. Within the scope of the Preliminary Design, a proposal should be made for rationalizing the number of road crossings in locations where technical conditions exist;
- Meet the terms for use of the loading gauge GC for electrified lines and enabling of the use of all intermodal transport technologies without restrictions;
- Reconstruction of architectural buildings along the railway line, primarily the station buildings and ancillary buildings including the station ancillary areas (e.g. the access, parking areas, bus stops, etc., as applicable);
- Implementation of the TSIs, provided that the economic feasibility of railway line reconstruction and modernization is preserved. Where the particular TSI cannot be fulfilled due to technical reasons, it is necessary to provide an explanation due to what reason it cannot be fulfilled. Likewise, where it is not economically feasible to implement the particular TSI, it is necessary to provide the explanation, in accordance with the Law on Interoperability of Railway System, justifying the deviation from the particular TSI;

- In accordance with the technological needs, for reconstruction of tracks at particular service points shall be considered in order to ensure the useful track length of 740m if possible due to local conditions (on approximately 20 km of line avoiding significant demolition of existing buildings and land acquisition), according to AGCT as well as construction of passenger platforms at the height of 0.55m, (separated passenger access to platforms and construction of elevators in railway stations in larger settlements along the railway line in order to enable access to stations and passenger platforms to disabled persons and persons with reduced mobility;
- Improvement of accessibility of the rail system for persons with disabilities and persons with reduced mobility in all railway stations.

The Project aims achieving the following objectives:

- Increasing the safety and efficiency of railway traffic;
- Increasing the running speed and at the same time reduce the train running time in passenger and freight services;
- Raising the railway line capacity;
- Reducing greenhouse gas emissions through the electrification of the line and replacing diesel traction with electric traction;
- Facilitate international freight and passenger railway traffic by establishing joint border station within Donja Borina station;
- Implementing the Technical Specifications for Interoperability (TSIs) unless the technical and economic analysis show that implementation of particular TSI is not feasible.

# 2. OBJECTIVE

The objective of the consulting assigment is the preparation of all necessary planning and technical documentation for the full scope of the Project, which consist of the necessary Spatial Planning and Technical Documentation and includes the following:

- Feasibility study with Preliminary design and the Environmental Impact Assessment Study;
- Environmental and Social Impact Assessment Study. This Study should provide impact assessment not only on environment but also shall also cover the full spectrum of social impacts, including land acquisition and resettlement, in accordance with the WB ESF. As a result, the preliminary design measures to avoid and minimize impacts as much as possible should be introduced through multiple E&S instruments compliant to World Bank ESF and include a Draft Resettlement/ Livelihood Restoration Action Plan as per ESS5, and Environmental and Social Management Plan (ESMP);
- Spatial plan of special purpose area for railway infrastructure corridor for part Ruma – Šabac – Donja Borina Junction – State border;

The sequence, structure and content of these documents should reflect the planning and designing process following Serbian Law and activities of responsible authorities for permiting and approval of technical documentation.

# 3. SCOPE OF SERVICES

The Consultant is required to carry out the following tasks:

## 3.1. Kick off Meeting

The Consultant will have a first meeting with the Client to confirm the tasks and objectives of the assignment and gather any additional instructions. During this kick-off Meeting, the Consultant will present an outline of the Inception Report (as described in 3.2) for comments from the Client.

## 3.2. Preparation of Inception Report

Following the Kick-off Meeting to be held with the representatives from MoCTI/PIU and SRI/PIT, the Consultant's first task shall be to meet with the relevant stakeholders and to gather the necessary data. Based on its technical proposal and the feedback from the meetings, the Consultant will develop an Inception Report that shall be the specific output of the Inception Period and present an overall approach and detailed program work plan and completion schedule for the services. The Report should discuss constraints and challenges identified by the Consultant and ways to address them in order to timely and effectively deliver the assignment. Gathered information, data and collected documents shall be included in the Inception Report, with a detailed description and assessment of the current situation. The minimum content requirement for the Inception Report is as follows:

- Introduction;
- Project planning and mobilization of design team;
- Data collection and site visit;
- Analysis of pre-studies and existing technical documentation;
- Description of current situation;
- Scope and Methodology for each document to be prepared;
- Work plan and schedule;
- Assumption, risks and mitigation measures;
- Conclusion.

## 3.3. Preparation of the Spatial Plans

Planning, use, arrangement and protection of the railway corridor should be based on the principles of arrangement and use of space established by the Law on Planning and Construction ("Official Gazette of RS", No. 72/09, 81/09 - correction, 64/10 - US, 24 / 11, 121/12, 42/13 - US, 50/13 - US, 98/13 - US, 132/14, 145/14, 83/18 and 31/19 other law,9/2020, 52/2021 and 62/2023), Law on Railways ("Official Gazette of RS", No. 41/18, 63/2023), Law on Spatial Plan of the Republic of Serbia from 2020 to 2035[1]. Law on Environmental Protection ("Official Gazette of RS", No. 135/04, 36/09, 36/09-other law, 72/09-other law, 43/11-decision US, 14/16, 78/18, 95 / 18-other law, 94/2024-other law), Law on Strategic Environmental Assessment ("Official Gazette of RS", No. 135/04 and 88/10), Rulebook on Elements of Railway Infrastructure ("Official Gazette of RS", No. 10/14), Rulebook on the content, manner and procedure of drafting spatial and urban planning documents ("Official Gazette of RS", No. 32/19) and other laws and bylaws, acts of the Republic of Serbia which define and determine the conditions, manner and content of preparation of planning and technical documentation.

For the railway line from Ruma to the state border with Bosnia and Hercegovina, it is necessary to prepare a Spatial Plan of the special purpose area of the railway infrastructure. According to Law on Planning and Construction an integral part of this Spatial Plan is the Report on the Strategic Environmental Assessment of the Spatial Plan.

[1] Preparation of Spatial Plan of the Republic of Serbia from 2021 to 2035 is currently under preparation.

In order to ensure that the implementation of all defined activities that precede the adoption of the all foreseen spatial planning documentation are carried out in optimal time frames (collaboration in the preparation of the proposal for the Decision on the preparation of the Plan, preparation of the Elaborate for Early Public Inspection, collection of documents and conditions from holders of public authorities, preparation of the draft Plan for public insight, all necessary corrections at the request of the Expert Commission for Plans), the Consultant is obliged on permanent and active cooperation with all relevant stakeholders (MoCTI, City of Belgrade, SRI etc).

*Table 2. Process of preparation of Spatial plan for the special-purpose area*

| No | Activity | Relevant Institutions | Expected Activity Duration |
|---|---|---|---|
| 1. | Adoption of the Decision on the development of the Spatial Plan by the Government of the Republic of Serbia and Decisions on the development of the Strategic Environmental Assessment of the Spatial Plan | Department of Urbanism and Spatial Planning-MoCTI | 2 months |
| 2. | Preparation of documents for early public insight | Consultant | 2 months |
| 3. | Early public insight | Department of Urbanism and Spatial Planning-MoCTI | 15 days |
| 4. | Obtaining conditions from the holder of public authorizations for the development of a spatial plan | Department of Urbanism and Spatial Planning-MoCTI | 1 months |
| 5. | Preparation of the Draft Spatial Plan | Consultant | 3 months |
| 6. | Expert control of the Draft Spatial Plan | Department of Urbanism and Spatial Planning-MoCTI | 5 days |
| 7. | Amendments to the Draft Spatial Plan in accordance with the Expert Control Report and SEA | Consultant | 1 month |
| 8. | Public insight | Department of Urbanism and Spatial Planning-MoCTI | 1 month |
| 9. | Public session and preparation of Report on the performed public insight into the Draft Spatial Plan | Department of Urbanism and Spatial Planning-MoCTI | 5 days |
| 10. | Amendments to the Draft Spatial Plan in accordance with the Report on the performed public insight | Consultant | 1 month |
| 11. | Procedure of adoption and publication of Spatial Plan | Department of Urbanism and Spatial Planning-MoCTI | 2 months |

## 3.4. Preliminary Solution

The Preliminary Solution shall be prepared to define all technical and functional specifications per chosen track alignment, that is most feasible and cost acceptable. The technical and functional specifications include, but are not limited to: track centreline(s), general vertical alignment, normal profiles for the open track and stations, general bridge disposition(s) and planned work(s), power supply and overhead contact line details, signalization and safety details and cable infrastructure general position, general drainage solution(s) with planned recipients, level crossings layouts and details on raising the safety levels, general positions of engineering structures (retaining walls, tunnels, culverts, overpasses, underpasses, substructure protections, etc), stations and station building reconstruction layouts and all other details necessary for definition and issuing of location conditions and for further development of the design through the preliminary design.

Preliminary Solution should be prepared according to the Rulebook on the content, manner and procedure of preparation and manner of control of technical documentation according to the classes and purposes of the objects ("Official Gazette of RS", No. 96/2023) and Rulebook on the procedure for implementing the unified procedure by electronic means ("Official Gazette of RS", no. 96/2023)

SRI shall be responsible for obtaining Location conditions based on the Spatial plan and the Preliminary Solution previously prepared by the Consultant and approved by the Client.

## 3.5. Feasibility Study with Preliminary Design

The Consultant shall prepare the Feasibility study with the Preliminary design, following all parameters and conditions defined by the Location conditions issued by the relevant authority per submitted Preliminary solution.

Preliminary Design shall be designed as a detailed follow up to the Preliminary solution, considering all specific conditions and restrictions, and shall include all documentation per Rulebook on the content, manner and procedure of preparation and manner of control of technical documentation according to the classes and purposes of the objects ("Official Gazette of RS", No. 96/2023) specifically relating to purpose and contents of the preliminary designs for linear infrastructure objects.

The Preliminary Design will provide the precise position, functional characteristics and technical and technological solutions for reconstruction and modernization of subject railway section, construction overhead line and electric power facilities, reconstruction and modernisation of telecommunications and the interlocking system and service points, as well as reconstruction and construction of new bridges, culverts, tunnels, station buildings, water protection and drainage, removal and reconstruction of road level crossings, in conformity with the requirements for the railway line infrastructural capacities and adopted international standards.

Contents of the textual and numeric documentation, graphic documentation scale and general level of detail prepared shall be done per laws, by-laws, standards and good engineering practices for preliminary designs of linear infrastructure objects.

All designs shall be developed considering the relevant national environmental, occupational and community health and safety regulations, labour management procedures and, WB ESF (E&S Policy and E&S Standards), WB EHSG, Good International Industry Practice (GIIP) and E&S Project documents (Environmental and Social Management Framework, Stakeholders Engagement Plan, Labor Management Procedures, and Resettlement Policy Framework) where the stricter ones prevailing. Also, WB requirement on stakeholder engagement should be adhered too. Additionally, WB recommendations on Climate Change impact minimization need to be accounted for, as well as structures' stability and safety as well as resistance to natural disasters and impacts attributable to Climate Change. Resulting design must be in line with measures and recommendations documented in the EIA and WB ESIA, which will be prepared in parallel with Preliminary Design.

The following sections outline the requirements for surveys, design requirements categorized by groups of works, and the requirements for the preparation of the Feasibility Study.

### *3.5.1. Survey works*

Geodetic survey works shall include, but should not be limited to:

- establishing the geodetic base for surveying as an operational polygon, which will serve for initial and updated surveying, marking of temporary and permanent (fixed) points,
- surveying and digitally recording existing terrain data, positions of all existing railway and nearby infrastructure, buildings, structures, visible installations and all other relevant objects,
- transfer of surveyed data into detailed geodetic survey maps with all surveyed points represented on a digital cadastre-topographic base,
- survey point coordinates aligned with the national coordinate grid,
- preparation of geodesy marking project and operational polygon as an integral part of the preliminary design,

- cadastre-topographic bases with established an up-to-date borders of land owned by RS managed by SRI (railway land area) in service points where the reconstruction is planned, as well as on the railway line where expropriation is required,
- performing of all other geodetic surveys for the purposes of preparing technical documentation,
- preparing geodetic elaborate analysis with the project for expropriation including field geodetic works for the purpose of implementing changes in the real estate cadastre in the process of expropriation.

Geotechnical survey works for obtaining detailed and reliable geotechnical data on conditions and parameters required for the design of the reconstruction and modernization of subject railway section, but should not be limited to:

- exploratory drilling and sample collection;
- engineering - geological mapping of exploration wells;
- excavation of exploration pits;
- geophysics geoelectric surveys where needed;
- detailed geotechnical core mapping;
- laboratory geomechanically research;
- preparation of geotechnical bases and documentation.

The number and depth of excavation pits, collected samples and other geotechnical works shall be defined in the Program of geotechnical works per all laws, by-laws, standards and good engineering practices.

The program of geotechnical works shall be subject to approval by Client. The Consultant will adopt all Client's requests for modification of the Program of geotechnical works with no additional charge.

The program shall include the sufficient number of samples for all engineering objects (tunnels, bridges, culverts, retaining walls, etc.), track substructure, buildings and borrow pits.

Geotechnical study (elaborates) shall include, but not be limited to:

- Detailed collected sample profiles;
- Longitudinal geotechnical terrain cross sections;
- Relevant underground water levels presented in profiles and sections;
- Laboratory results;
- Conditions for structure foundations;
- Hydro-geological conditions;
- Conclusion with suggestions for substructure/soil replacement;
- Studies shall be prepared for the tunnels, bridges, railway line on the ground including building (stations and other architectural structures), with the geotechnical methodology (investigation, terrain inspections, samples etc.) which is suitable for each of the stated entity. Ground conditions around foundations of the existing bridges, culvers, overpasses, etc. (including ones in water), shall be prepared in the scope and content that is necessary for foundations evaluation and design for foundation reconstruction, as well as ground conditions of the existing tunnels. Due to possible need for the existing tunnels profile enlargement, geotechnical study shall include ground conditions and all data necessary for the design for the tunnel structure reconstruction.

Additional geotechnical surveys and/or laboratory research shall be done by the Consultant on request by the Client.

For these services, the consultant shall prepare OHS plan compliant to ESF, WB EHSG and national legislation before exploration/survey activity commences, subject to PIU and WB approval.

### *3.5.2. Civil works design*

The Consultant will adhere to the following general and specific design conditions when preparing this Preliminary Design.

- the maximum speed on the railway shall be up to 120km/h,
- Station layouts shall be designed in accordance with conclusions of the traffic design and new conditions for accommodation of train lengths of 740.0m at appx. travel distances of 20 km.
- Keep the existing positions of service points (stations and halts), any change in the position of the service points should be technically, technologically and economically justified, and approved by the Client.
- Design the Donja Borina station as a joint border railway station in terms of station track capacity and necessary facilities and equipment for accommodation of institutions from both countries
- railway gauge shall be standard 1435mm with UIC60 rail;
- the railway shall meet the GC loading gauge;
- Switches in the service points shall be designed in accordance with regulations and standards for this railway category and all other conditions, in good engineering practices;
- In the stations, track alignment distance of minimum 4.75m shall be provided;
- In accordance with the technological needs, standards, TSIs and local conditions, construction of platforms in the service points shall be envisaged;
- Construction of noise barriers shall be provided and the position shall be defined after the adequate measurements and analyses are conducted;
- define the centreline, vertical alignment and all other track geometry parameters for the maximum allowed train speeds in accordance with approved route of railway line;
- subgrade/foundation and substructure shall be designed per parameters defined in the geotechnical and survey studies for loads of a D4 category railway track (225 kN, 80 kN/m);
- substructure formation shape shall be designed with typical cross-section dimensions for D4 category main railway line, including widening of formation in curves, cable gutters and other needed installations;
- subgrade/foundation and substructure formation materials shall be planned economically justifiable and from nearby borrow pits, quarries and other sources as to avoid unnecessary transportation costs. As much as possible, no new borrow pits, quarries and similar exploitations of mineral resources will be opened for the purposes of the project. Still, existing ones with valid licenses and concessions can be used;
- detailed static calculations shall be done in accordance with the applicable regulations and standards for all engineering and substructure objects such as culverts, bridges, retaining walls and other similar structures to, first and foremost, ensure stability and safety of the infrastructure;
- inspection and examination of all bridges, tunnels, retaining walls, culverts and all other engineering objects and structures that are planned for reconstruction shall be done and results presented in the design;
- superstructure on the open track and the railway part of the station tracks should be designed with the appropriate type of rail pre-stressed concrete sleepers, and elastic fastenings in category 1 crushed stone ballast;
- tracks will be designed as CWR track on the full length of the subject railway section;
- switches shall be designed per relevant standards and rulebooks to enable the most suitable functioning of the stations, specifically using simple switches and switch track connections;
- switches shall be designed as welded in CWR track;

- Design alignment of line in such a way that main milage of line is foreseen on part Ruma – Junction 1 – Junction 3 – Loznica – Donja Borina Junction – State border, and that branches of line are parts Junction 1 – Junction 2 – Šabac, Šabac – Junction 3 and Donja Borina Junction – Zvornik;
- RLC that remain in operation shall be designed to meet the minimum 60° angle parameter, constructed with modern rubber panel systems and in widths to accommodate common local cycling and pedestrian traffic;
- Design of level crossings will, in addition to signalization (required by the national legislation, WB EHSG and GIIP), include safe crossings for pedestrians and cyclists.
- existing industrial track capacities in private sector ownership connected to stations in this project's scope shall be accounted for and their connection to the public railway designed and kept operational within the design unless specifically stated otherwise.

### *3.5.3. Bridges, overpasses, underpasses, retaining walls and culverts*

In accordance with the age of structures along the railway line, condition of the structure, required clearance gauge and all other conditions listed within, all structures on the subject section shall fulfill the following requirements:

- Bridges, culverts and other engineering structures shall be designed to meet the load category as on the rest of the railway section (D4 225kN/axle and 80kN/m'), in accordance with the valid Rulebooks, standards and Eurocode norms taking into account all the impacts specified in these regulations as well as the loading schemes for special vehicles, as well as provide a clearance profile that allows safe and unimpeded movement of railway vehicles with the GC loading gauge;
- For existing bridges and all other structures (such as culverts, overpasses, underpasses, retaining walls, etc), the structural condition, the load bearing capacity testing for all structural elements (from foundation to the superstructure), and evaluation of the results shall be performed. Measures and design for the reconstruction or replacement shall be provided for each structure, according to the obtained testing results, in order to meet the above stated new design requirements.
- The structural control analysis for bridges and all other structures shall be done in accordance with the valid Rulebooks, standards and Eurocode norms taking into account all the impacts specified in these regulations as well as the loading schemes for special vehicles; Bridges shall be individually processed. Culverts shall be designed as standard plate reinforced concrete frame constructions with closed surface;
- The structural control analysis for retaining walls shall additionally include analysis of state of existing drainage and its impact to the stability of the structure.
- Structural analysis and processing of documents for culverts shall be performed based on the same principles as for the bridges, but in the scope that is necessary for the particular culvert type.
- Bridge over the Sava river in Šabac, “Old bridge”, km 30+173 (L=680.0m) as the largest bridge in the Project, shall be subject to a separate detailed structural control analysis, which shall include as minimum the load bearing capacity testing, static and dynamic testing methods for all structural elements from foundation to the superstructure. Design for reconstruction or other measures by which it can meet the above stated new requirements shall be provided;

### *3.5.4. Tunnels*

Given that the tunnel gauges along the entire railway section are non-satisfactory, i.e. that the tunnels do not meet the UIC-GC gauge for electrified railway lines, it is necessary for the existing tunnels to be reconstructed so as to fulfill the requested requirement regarding the clearance gauge.

Technical solutions for the tunnels covered by the design must be modern and cost-effective and all enclosures must be well structured and clearly presented, in accordance with the following:

- Technical elements of the alignment in the tunnel must be completely reconciled with the technical elements of the alignment in the open track;

- Tunnel tube clear opening shall be defined in accordance with the UIC-GC clearance gauge for the straight track and for the curves R>250m, in accordance with the Deutsche Bahn instructions DB 800.0130 with the catenary clearance gauge, in accordance with the valid legislation and the applicable Rulebooks;
- In addition to the clearance gauge, the designed tunnel tube cross section must also provide the space for accommodation of drainage channels and for laying of all the necessary installations. Attention shall be paid to providing the access for maintenance purposes;
- Track within the tunnels shall be ballasted track. Ballast thickness must not be less than 35cm calculated from the sleeper bottom edge up to the regulating concrete course in the tunnel (invert arch);
- The tunnel space must be reliably protected against ground, infiltration and surface waters. In order to achieve this, modern waterproofing shall be envisaged. When devising these solutions, in connection to the dimensions and quantity of draining elements, the hydrological conditions of the area in which the tunnel is being built and its length shall be taken into account;
- Water discharges (drop ends) shall be positioned where water impact shall not negatively affect the terrain and railway line stability;
- Analysis of structural impact and dimensioning shall be done based on the valid regulations for the adequate materials and constructions. Modern software analysis packages shall be used for these purposes and construction technology shall be taken into account. Analysis parameters and formed analysis models must be in line with the data and the conditions specified in the geotechnical study specially prepared for each tunnel including ground water condition (such as but not limited to: water levels, variations over time, expected amount of water inflow, etc.), geometrical requirements and clearances, load and load combination including seismic forces. The envisaged types shall be adequately positioned and their presence along the longitudinal profile shall be assessed by position and quantity. The locations of treated analysis profiles shall be marked on the same drawing;
- In design preparation, all valid legislation, regulations and standards shall be used. If there are no adequate norms and rulebooks for the certain parts of technical documentation, the Designer shall use the relevant provisions of SIA 197/1 standard.
- For each existing tunnel the structural condition shall be inspected, all testing performed in order to assess the tunnel's structure stability and safety for the intended use. Measures and design for the reconstruction or replacement shall be provided for each tunnel, according to the obtained testing results, in order to meet the new design requirements.

### *3.5.5. Hydrotechnical facilities*

The design should include all facilities that ensure the safety and usability of the railway line and associated structures from all types of water that may occur and have harmful effects during the intended operational period. Particular attention should be paid to the following:

- Substructure, tunnels, bridges, culverts, overpasses, underpasses and track bed drainage shall be designed to fully conform with standards and good engineering practices for soil and water level parameters presented in the geotechnical survey elaborates;
- Hydraulic verification of the capacity of culverts and bridges;
- Protection of the riverbeds in bridge areas;
- Regulation works on watercourses and protection of the track bed in the watercourse zones;
- Water supply and wastewater drainage in stations (internal and external installations);
- Measures to protect water sources, etc.

### *3.5.6. Station buildings and facilities*

Design for station buildings and facilities must foresee:

- Plan for the reconstruction of existing station buildings and the arrangement of station complexes (station buildings with other accompanying facilities, surfaces, and technical infrastructure) in stations, according to the planned scope of work and in accordance with the specific requirements of the Client.
- Include the construction of new facilities for the accommodation of heavy motor trolleys (TMD)-a garage with two tracks, a channel for inspection and repair of TMD, office, and warehouse space for maintenance of OCL, at a location to be defined by the Investor.
- For the accommodation of signalling and safety equipment and telecommunication equipment, plan the construction of new buildings or refurbishment of existing ones (if economically acceptable) that fully meet all the requirements of the relevant laws and bylaws for the stated equipment.
- Design Donja Borana station as a joint border station that will house institutions from both countries responsible for border control (railway, customs, border police, veterinary, and phytosanitary inspections). Additionally, based on the anticipated international traffic forecast, define the required track capacities and the appropriate station layout. Passenger platforms shall be designed as 550 mm height with canopies in adequate lengths,
- Passenger platforms shall be connected to station buildings via pedestrian underground passages. Technical solutions will be provided for access of elderly passengers and those with reduced mobility (lifts, escalators, etc.).
- For all existing buildings (stations and others), the structural conditions shall be inspected, and the load bearing capacity testing and evaluation of the results shall be performed. Measures and design for the reconstruction or replacement shall be provided for each building, according to the obtained testing results, in order to meet the new design requirements.

### *3.5.7. Electric traction system and facilitiess*

#### *3.5.7.1 Overhead contact line*

The electrical infrastructure of the railway line and station facilities should be designed in accordance with the technical specifications for interoperability of energy, control, management, and signaling structural subsystems.

The railway line Ruma - Šabac – Donja Borina - State border is currently not electrified, and therefore the following steps are required:

- Plan the electrification of the single-track railway line and station facilities of Ruma - Šabac – Donja Borina - State border using a 25 kV - 50Hz, system of fixed installations for electric traction (IFTE), with remote control.
- Design the catenary as a simple compensated contact line without a "Y" feeder for speeds up to 120 km/h. The contact wire height from the ground is 5500 mm, and the normal overhead line height is 1400 mm. The normal tension force for the catenary and contact wire is 10 kN. The contact wire should have a cross-sectional area of Ri 100 with 100 mm2, the supporting wire BzII with 65 mm2 cross-sectional area, and the feeder and supply lines for 25kV should be made of Cu wire with a cross-sectional area of 150 mm2.
- Excavate pit foundations, pour concrete foundations for the pillars, portals, and anchors with minimum C25/30 concrete, using B500 ribbed reinforcement. Use fine-grain material for the cap of the foundations and C25/30 concrete. All these steps should be carried out in accordance with the geotechnical report for railway alignment.
- All sectioners, with or without the grounding knife, which are installed in the OCL, must be motor operated with remote control, except the sectioners for separating the IFTE facilities (ET substation, Sectioning facility and neutral section facility) on OCL, which are to be provided manually operated. These sectioners must be accessible from the railway (the fence of the facilities should not hinder access and operation). Each sectioner should be marked with numbers indicating its purpose and order in the station.
- Provide formation of new OCL sections and electrical power facilities (EPF).

- Construct new facilities for the accommodation of heavy motor trolleys (TMD) – a garage with two tracks, a channel for inspection and repair of TMD, office, and warehouse space for maintenance of OCL and EPF.
- Provide remote control of motor-operated sectioners from the central remote control center, the train dispatcher's office with remote terminal unit (RTU) cabinets with hierarchical control from the dispatch control unit (DCU), and local control at the sectioners locations. Place RTU cabinets in the train dispatcher's office.
- Install new supporting structures for the catenary: two-legged masts made of 2U profiles and two-legged portals made of 4L profiles, along with complete equipment for supporting, fixing positions, suspending and tensioning the catenary wires. Mechanical protection of the portals' legs should be provided at the loading ramps and tracks in the stations.
- Install complete sets of suspensions for the contact wire (single, double, and triple brackets) with fasteners.
- Install Mid-Point Anchor with fasteners on the pillars and rigid portals, using galvanized steel wire.
- Install devices for solid tensioning of the contact wire with fasteners and complete sets of AZ devices with fasteners, compensating plates, and concrete weights on the pillars and rigid portals.
- Ground the return conductor and the railway track. The method of installing the return conductor should be consistent with the applied signalling and safety system. Ground the supporting structures of the catenary and connect them to the return conductor following the technical solutions provided in TPE - KM 1, Part IV - Return Conductor and Grounding.
- Install track crossings, inter-rail and inter-track connections. Ground the pillars and rigid portals with FeZn 95mm² wire to the rail of the catenary return conductor.
- Ground the artificial structures (bridges, overpasses, footbridges, and other metal structures) to the rail of the catenary return conductor using spark gaps and special grounding electrodes (probes) with protective grids and signs "High Voltage - Danger to Life" in the zone within 8m from the track centerline.
- Implement dual grounding for pillars and rigid portals with disconnectors, plants (ETS and SF), pillars, and rigid portals located in the station, platform, and platform access area accessible to the public, as well as pillars and legs of rigid portals located on the left and right of the pedestrian crossing gates.
- Install new pedestrian crossing gates with concrete pillars, complete with upper and lower wires, warning signs "High Voltage - Danger to Life," and traffic sign "Limited Height 4.5m" at level crossings.
- Mark the pillars and portals with inscriptions: TOR (GIŠ) imprint, pillar or portal numbers, and distance from the OHC pillar axis to the track centerline.
- Install signal plates: "Signals for Electric Traction," "Beginning/End of Isolated Crossover," and signal sign "Maneuvering Limit."
- As part of the preparation of graphic documentation for the catenary network, provide:
    - Projects of planned facilities with open railway and station dispositions,
    - General sectionalization and power supply schemes for the catenary network,
    - Specific sectionalization schemes for stations,
    - Schemes for the return conductor and grounding,
    - Technical documentation for the special technical solutions during the construction of the catenary network.
- Power supply to the catenary network from mast substations 25/0.23kV should be carried out based on the instructions "Temporary Provisions on Technical Conditions for Connecting Other Consumers of Electrical Energy to Stable Electric Traction Plants" (ZJŽ 14, number 28/85-123), or alternative solutions compliant with EU standards for railways in line with TSI.

The design shall also include requirements for inspection and testing of the OCL, the functional settings of traction system devices and equipment, and necessary testing and commissioning of OCL.

### *3.5.7.2 Power supply facilities*

The project aims to electrify the single-track railway line Ruma - Šabac - Zvornik - State border, which involves building stable electric traction facilities (ET substation, Sectioning facility and neutral section facility), 20(10)/0.4 kV transformer stations, lightning protection installations, platform lighting, internal electrical installations, and lighting with the installation of new distribution cabinets to increase the level of reliability and safety in traffic operations.

All station facilities should be equipped with energy-efficient solutions, such as solar power plants, LED lighting, and reactive power compensation in 20/0.4kV transformer stations.

The electrification of the railway line Ruma - Šabac – Donja Borina - State border, in terms of building the IFTE and the required number of facilities (ET substation, Sectioning facility and neutral section facility), as well as the required number of power supply points for OCL, shall be coordinated with the high-speed railway project on the Stara Pazova - Šid section to avoid reconstruction and redesign of facilities in the reconstruction through the high-speed railway project Stara Pazova - Šid.

Plan the construction of new ETSs based on the energy calculations, including the construction of the connecting lines (110 kV overhead lines and 110 kV overhead line fields) for supplying electric traction facilities, which should be carried out in accordance with the technical requirements of Elektromreža Srbije, the relevant Electric Distribution Company, and the Branch of the Distribution System Operator.

In addition to ETS facilities, plan the construction of sectioning facilities, following the ETS-SF-NSF-SF-ETS *("EVP-PS-PSN-PS-EVP")* principle. For facilities to be reconstructed through the high-speed railway project Stara Pazova - Šid, modify the project to expand the necessary number of power supply points for OCL (in the NS facility in Ruma) to ensure reliable power supply to existing and planned electrified railway sections. Sectioning facilities should be planned in station areas, as well as motor-driven disconnectors for supplying tracks or groups of tracks within the station area.

The number and location of motor-operated disconnectors should be planned based on the technical solutions for building the catenary network. The equipment for controlling the motor-driven disconnectors should primarily be powered from the distribution network.

Power supply to the catenary network from the pole substations 25/0.23kV should be done exclusively based on the instructions "Temporary Provisions on Technical Conditions for Connecting Other Consumers of Electrical Energy to Stable Electric Traction Plants" (ZJŽ 14, number 28/85-123), or alternative solutions compliant with EU standards for railways in line with TSI.

Implement a project for remote control of ET substation, Sectioning and neutral section facilities, as well as motor-operated sectioners, from regional dispatch centers and a unified remote control center that is being designed and constructed in the station Beograd Ranžirna. Coordinate the remote control setup with the maintenance services of the electric traction infrastructure.

Plan the integration of remote control devices into the existing SCADA system in the dispatch centers.

**110/27.5kV Electric Traction Facility, 2x7.5/10 MVA**

- Construct 110kV supply lines and 110kV overhead line fields.
- Coordinate the Technical Control System (TSU) of the 110kV part of the facility with the operating rules of the transmission system and the specific requirements of the transmission system operator.

**110kV Switchyard**

- Install 110kV SF-6 gas circuit breakers and 110kV measuring transformers, with modern technological solutions and in compliance with the requirements of the transmission system operator.

- Plan the busbar systems for 110kV, following the technical design for connecting to the EMS and ODS transmission systems.
- Construct 110kV sectioners according to the standard design for electric traction substations.
- Purchase new 110/25kV power transformers with a capacity of 7.5/10 MVA if the railway project requires it.
- Install high-voltage equipment to enable regenerative braking in electric traction.
- Install two electronic tap changers (TAPCON) for regulating the secondary voltage and enabling individual/parallel operation of 110kV/27.5kV power transformers for each EVP.
- Install current transformers for Un = 110 kV.
- Install voltage transformers for Un = 110 kV.
- Install surge arresters for Un = 110 kV.
- The return conductor, operational, protective, and lightning grounding should be combined and connected to the basic grounding system with a lattice grounding system in the 110 kV field. Ground the fence and lighting poles with separate grounding devices. Install the grounding busbar with current measurement of the return conductor in a freestanding cabinet located between two power transformers.

**25kV Switchyard**

- Install 27.5 kV vacuum circuit breakers on all traction supply points and in the switchgear field mounted on carts with the required number of command and signal contacts.
- Install motor-operated disconnectors with a specific number of command and signal contacts.
- The circuit breakers and sectioners should be remotely operated from the USBU, the central station of the facility, locally from the device cell, and manually.
- Install motor-operated disconnectors that can be operated from the front side of the cell next to the doors.
- Provide electrical and mechanical interlocking for the operation of disconnectors and circuit breakers.
- Install current transformers for Un = 25 kV.
- Install voltage transformers for Un = 25 kV.
- Plan the construction of medium-voltage equipment to enable regenerative braking in electric traction.
- All internal medium-voltage equipment (copper busbars, grounding conductors, supporting and conductive insulators, etc.) should be installed according to the regulations for building electric traction facilities, using a protected busbar system.
- All low-voltage equipment should be installed with modern technology in cabinets with removable compartments for equipment (digital protection relays for transformers and catenary, voltage regulation, rectifiers for supplying auxiliary equipment, etc.) with the possibility of control from regional USBUs and JDCs and with visible confirmation of the device position change on the front side of the cabinet.
- The connection between external and internal equipment should be done with command and signal cables placed in appropriate cable channels.
- The power supply for equipment, lighting, and thermotechnical installations in ETS, SF, and NSF facilities should be primarily provided from the distribution network.
- As a backup power supply, provide stationary batteries 110 V DC, with suitable uninterruptible power supply devices, autonomy of at least 3 hours, and a diesel generator of appropriate power.
- For self-consumption of facilities, provide installation of a "house transformer" 25/0.231 kV, 100 kVA, with a manually operated switch for disconnecting from the busbar system.
- Install surge arresters for Un = 36 kV at the switchgear fields.

- Plan spaces for equipment storage, spare parts, and, for the EVP facility, rooms for temporary worker accommodation and sanitary facilities.

**Metering and Protection Equipment**

- Plan the installation of relay protection equipment for the power supply points for the catenary with microprocessor technology (distance protection relays with at least two stages of settings and backup overcurrent protection). Install digital relays for distance protection and backup overcurrent protection in the PS facilities.
- Provide appropriate protection for power transformers, including at least overcurrent and short-circuit protection, boiler protection, differential protection, Buchholz protection, and thermal protection.
- Enhance the capabilities for measuring and controlling electrical quantities in the facilities, including the ability to determine the location of faults on the 25 kV lines either through the secondary function of the metering relays or by installing separate devices. The measurements should include the effective values of currents and voltages, with the ability to detect changes in these quantities. Extend the functionality for monitoring the status of power transformers (thermal imaging, insulation status).
- Connect to the regional USBU and JDC via optical cables.
- Measure the return conductor current and compare it with the currents of the power supply points in a separate freestanding above-ground cabinet located between the transformer fields.

**Power Supply Devices**

- Plan a separate 220V distribution cabinet with a main switch, undervoltage relay, metering instruments, and the ability to transmit measured values to the regional USBU and JDC. Provide sufficient number of outlets for all consumers and reserve outlets for possible system expansion.
- Plan a separate 110 V DC distribution cabinet. Provide reserve outlets as well.
- Install two separate rectifiers 220/110 V, a supervisory unit, 110/220 V inverter, and rectifiers for supplying remote control devices that are compatible with or identical to the new system (for the high-speed railway Stara Pazova - Šid currently under design). The new rectifiers should be resistant to possible overvoltage conditions to ensure continuous operation and safety/protection of the powered equipment even under the most challenging conditions.
- Install 110 V accumulator batteries.
- Provide control-signal and power cables for connecting devices to distribution panels, relay-command stands, and the remote-control center. Lay the cables in cable channels.
- Place all equipment and gel technology-based accumulator batteries in closed cabinets with the necessary ventilation for cooling the components.

**Remote Control (RC)**

- Plan a new RC system based on modern solutions, connected to regional and central remote control centers. The new devices in controlled locations should provide sufficient signals/commands and enable data/information transmission according to the projected state of devices and equipment in the facilities. Provide real-time data transmission for all measurements conducted in the facility.
- Ensure data/information transmission to the transmission system operator in accordance with the operating rules of the transmission system and specific requirements of the transmission system operator.
- Ensure a 20% data/information transmission backup system.
- In the controlled location, plan one switch for selecting remote/local control.

- Connect to the remote-control center via optical cables, with mandatory redundancy for the transmission path.

**Miscellaneous**

- Plan electrical installations, external and internal lighting, operational, protective, and lightning grounding. The grounding should be interconnected with the steel grid grounding of the ETS. The metal fence surrounding the ETS, at least 2.5 meters high, should have separate grounding with barbed wire on top.
- Install a video surveillance system for the interior and exterior of the ETS, SF, and NSF facilities, as well as access control and signal transmission to the dispatch center for security.
- Provide fire protection installations, fire alarm control panel, and a system for access control and unauthorized entry detection into the facility.
- Include necessary thermal equipment for cooling/heating electronic equipment.
- Plan electrical installations for lighting the interior and exterior for normal operation and emergency/reserve (110V DC) lighting, Schuko outlets for connecting portable devices to 220V AC and 110V DC in line with standard solutions for electric traction facility buildings.
- In all official locations, equip the facilities with energy-efficient solutions, such as photovoltaic power plants for power generation and self-consumption, LED lighting, and reactive power compensation in (20)10/0.4kV transformer stations.

### *3.5.8. Signalling and interlocking*

Due to the existing condition of the signalling-safety and interlocking facilities, as a consequence of long exploitation, theft, damages and the inability to regularly supply spare parts, it is necessary to replace these facilities and devices (internal station devices, open railway devices, level crossing devices) with new modern electronic devices.

The signalling-safety and interlocking design shall include:

- The existing signalling safety and interlocking devices must be replaced with modern electronic devices. Electronic devices must be in compliance with SRPS EN 50126-1, SRPS EN 50126-2, SRPS EN 50128, SRPS EN 50129 standards;
- For electronic SS devices in stations, open track SS devices and SS devices for RLCs, the safety integrity level must be 4 in accordance with SRPS EN 50129, for complete SS device.
- Newly installed devices must be connected to neighboring railway stations through a suitable interface;
- Installation of devices and facilities for interstation dependence (ID);
- Service points and sections of open track must be equipped with conventional electronic signal-safety devices with light signals and track devices for precise control of train speed, allowing the speed of trains equipped with the locomotive part of the auto-stop device (I-60 automatic stopping system) at speeds up to 160 km/h, as well as equipping them with the European train control system (ETCS) level 1, in accordance with the Specification of user/functional requirements on the IŽS railway network.
- Issuing commands and monitoring the condition of individual elements of the device by the traffic operator; for this purpose, provide an operator workstation based on a PC, which together with peripheral devices (monitor, keyboard, mouse) form a human-machine interface (HMI). Equip the operator's workstation with both an active and a backup workstation. Include within the design, the required number of monitors with clear visual representation of the complete track with the safety elements. Control shall be provided via keyboard and mouse. The display of the SS and interlocking elements shall be provided in accordance with the graphics adopted by IZS and the latest attached catalog of symbols;
- In all stations, the switches must be equipped with electrical switching devices with connecting accessories adapted for concrete sleepers;

- Installation of an electric heating system of switches with power supplied from the OCL;
- Installation of new cables for connecting internal and external SS and interlocking devices. Insulated polyethylene (PE) cables shall be provided for connecting external safety elements in stations and on interstation distances and/or dedicated optical cables for needs of SS. Provide separate cable networks and separate cable cabinets for signals, for switches, for axle counters, for devices for automatic stopping and control, and electrical switch heating system. The cables must be protected against the disturbing effects of traction electrical current;
- Data transmission, command and control for dependency shall be provided through vital signaling network and dedicated SS fibers in fiber optic cable. Provide physical redundancy of the vital signal network both in terms of active components (layer A and layer B) and in the form of two optical cables that are routed along independent routes on one and the other side of the tracks.
- All level crossings that are to be secured in accordance with the design of traffic technology must be designed in electronic technology. The existing level crossing devices must be replaced with modern electronic devices with replacement of complete cable network connecting the external elements of the RLC with the internal device. Existing level crossing facilities must be adapted or replaced in accordance with the applicable technical conditions and standards regarding the accommodation and installation of the aforementioned equipment. The safety integrity level of RLC devices made in electronic technology must not be less than 4 in accordance with SRPS EN 50129. The electronic RLC device must have a failure detection system and provide indications of failures (disruptions and malfunctions). All disruptions and malfunctions must be recorded;
- Video surveillance shall be provided for all level crossings, with at least 3 cameras per RLC and remote access to the video surveillance device, with the possibility of control at the corresponding center.
- Provide lighting of the level crossing intersections in populated areas, as well as away from populated areas with a shielded light source. In the event that it is technically impossible to supply the power to lighting of intersections outside populated areas from the network which powers the devices of the railway infrastructure, provide it using solar technology with lighting autonomy during nighttime for 365 days a year. The solar panel, LED reflector and battery shall be integrated as one product.
- Signalling-safety and interlocking devices in stations shall be provided with interfaces for connection to the future remote traffic management system (CTC), with all the necessary equipment for integration into the planned regional and Unified Dispatch Center (JDC).
- Power supply in service points shall be provided in the form of an uninterrupted power supply system in accordance with the requirements of the installed equipment. The power supply of the device shall be realized in three levels with regular, auxiliary and backup power supply. The transition from one type of power supply to another type of power supply is done automatically and must not cause changes to the existing state of the SS device. Parts of the devices for powering SS and interlocking devices in stations are dimensioned and supplied in such a way as to enable power supply to SS and interlocking devices at the interstation distance and devices for securing level crossings. In the event of a failure on the network from which the regular power supply is provided, power shall be switched to the auxiliary power automatically, and then, within a maximum period of 60 seconds, to the backup power supply;
- For accommodation and housing of SS, interlocking and telecommunication equipment, construction of new facilities, fully in accordance with all requirements for the specified equipment as well as all recommendations of the equipment suppliers;
- All SS and interlocking devices and facilities designed in accordance with applicable valid Rulebooks;

### *3.5.9. Telecommunication, information and communication plant*

The design of the telecommunications system must be harmonized with the dynamics of realization and construction of the JDC project, the project of modernization and reconstruction of the railways on the territory of the Republic of Serbia, section Stara Pazova - Šid, as well as other projects that include or are adjacent to the section in question if works have already been carried out on telecommunication systems that are the subject of this project.

General conditions for housing telecommunication and information-communication equipment:

- Arrangement of space for the accommodation of the equipment shall be provided, in order to meet the climatic and mechanical characteristics required by the equipment.
- All necessary technical solutions for power supply and grounding required by telecommunication system devices shall be provided, in accordance with valid regulations in this area.
- The design shall include rack cabinets for telecommunication systems and IT equipment with the corresponding local computer network.

General conditions for cable infrastructure:

- On concrete bridges subject to reconstruction or renovation works, replacement of all concrete cable troughs shall be provided;
- Replacement of concrete cable troughs shall be provided also on concrete bridges that are not subject to works if the troughs or their covers are damaged;
- On steel bridges subject to reconstruction or renovation works, replacement of all tin cable troughs shall be provided;
- Replacement of tin cable troughs shall be provided also on steel bridges that are not subject to works if the troughs or their covers are damaged;
- In stations, all damaged concrete cable troughs and their covers shall be replaced.

Cable infrastructure for laying of optical pipes:

- New cable infrastructure for laying PEHD pipes, along the entire route, should consist of Ø40 PEHD pipes laid in a trench, concrete or plastic troughs, tin troughs, cable ducts, inlet shafts, into which optical cables will be blown in as well as 2 PEHD pipes which will represent a reserve backup. Only one optical cable can be blown into one PEHD pipe;
- On the open track, at places where a new trench for railway copper cables is planned, the pipes should be placed in the same trench;
- On the open track, at places where a new trench for railway copper cables is not planned, a trench at a minimum distance of one meter from the route of the railway cables shall be provided. Where this is not possible, a technical solution shall be provided;
- The depth of the cable trench must not be less than 0.8 m;
- In stations in which there are existing concrete troughs , PEHD pipes Ø40 shall be laid in them. Where this is not possible, a technical solution shall be provided;
- Installation of the optical cable in stations shall be done by using the existing shaft for the installation of other cables. Where this is not possible, a technical solution shall be provided;
- Crossing over bridges shall be done by using existing metal troughs, through which existing cables pass. Where this is not possible, a technical solution shall be provided;
- Passages under the railway or road shall be done at a depth of 1.2m, where 4 PVC pipes Ø110mm shall be laid.

Railway cables:

- Cables shall be relocated and/or protected in such a way that they are completely safe from construction work on substructure, superstructure and structures. Following the cable intervention, correct operation of all existing telecommunication, signalisation and safety, interlocking and remote control systems that are in operation shall be ensured/established.
- If necessary, railway and local cables may be temporarily moved in order to secure the necessary connections, and following the completion of the construction works, they must place at their final position.
- Railway cable (copper type STA or optical with equivalent characteristics), in terms of characteristics and capacity, shall be adapted to telecommunication, signalisation, safety and interlocking and other systems that are intended to operate on it, taking into account the construction and electrification of the

railway (25 kV, 50Hz). The railway cable must meet the conditions for laying it adjacent to the electrified railway, as well as be appropriately certified by the Directorate for Railways, while the construction and type of the cable shall be determined by the systems that operate on it and the impact of the electric traction current.

- In all stations, a new local cable network shall be designed, which shall connect all facilities in the station area for the operation of telecommunication connections and information and communication equipment.
- In all station facilities, plan a local computer network that will be integrated into the existing Intranet network of IZS.

Optical cables:

- Plan the installation of railway and interstation optical cables on subject sections. In all stations, plan for the installation of a full structure railway optical cable, with the forwarding of certain fibers in accordance with needs and the intended purpose of the optical fibers;
- Flexible optical cables are singlemode with 96 and 48 optical fibers in accordance with G.657A1 standard. A 48-fiber fiber optic cable, which is represents the redundance to a 96-fiber fiber optic cable, shall be planned if required by critical services and SS and EE systems;
- Optic cables shall be laid underground, along independent routes on both sides of the railway, on the subject section of the railway, alternatively one (redundant) per OCL, and in the stations in accordance with the civil engineering plan of the station;
- An additional interstation optical cable with 24 optical fibers, in accordance with G.657A1 standard, shall be used for the operation of telecommunication, energy, signalisation-safety and interlocking, and other systems in service points and points along the railway (level crossings, energy facilities, railway radio stations) in which installation of optical cable is planned, which would be laid between all stations of the subject section. The additional interstation optical cable shall be laid through a separate laid optical tube in relation to the track optical cables. It shall be installed with a full construction into the stations;
- The optical cable shall be in accordance with the ITU-T standard, non-metallic, reinforced, with protection against rodents and moisture penetration;
- Provide local cable networks in stations for systems that require fiber optic operation;
- The railway optical cable should have 12 optical fibers per tube;
- The optical cable is intended to be blown into one Ø40 PEHD pipe along the entire route.
- The factory length of the optical cable shall be at least 4 km and 500m for PEHD pipes;
- Optical splitters shall be 19" with E2000-APC connectors;
- As optical cable reserve, 15m per 1km shall be left; 15m is left on the extensions on both sides; in each room where the cable is to be installed, leave a 15m reserve. In addition to the reserves defined by the conditions, leave a reserve at stops, level crossings, bridges, tunnels and facilities where the installation of optical cable is not planned.

Dispatchers and railway telephone devices:

- In all stations, dismantle the existing station dispatcher telephone devices and telephones at the entry and exit signals. Dismantle all telephones on the open track. Align the disassembly of the elements of railway and dispatch devices with the technology of the works, while establishing the necessary temporary connections for communication;
- Install new digital station dispatch telephone devices in all stations (central devices with TK desk and anti-vandal telephones). On the open railway, install telephones in anti-vandal housings: with selective transmitters at spatial signals and telephones at level crossings. Provide replacement of telephones. In the dispatch centers of CTC, USBU and JDC, aligned with the SS and EE designs, install the dispatcher line telephone USBS and USBEV systems, which are made with modern technology (switchboard with TK desk);

- In the dispatch centers of CTC, USBU and JDC, aligned with the SS and EE projects, install the dispatcher line telephone USBS and USBEV systems, which are done with modern technology (switchboard with TK desk);
- Dispatch telephone devices in stations and dispatch centers shall have the ability to work with both copper pairs and optical fibers;
- The design of railway telephone devices and the dispatch telephone system must be in accordance with the traffic technology, the technology of the SS system and the technology of the electric traction system, in order to provide means of communication to the necessary personnel in accordance with the mentioned technologies, if required;
- Provide the appropriate number of register phones in service points in accordance with the Traffic Technology;
- Provide the necessary equipment, material and works for the implementation of temporary telephone connections for regulation of traffic after the disconnection of signaling and safety devices and the dismantling of station railway telephone devices for proven communication of traffic personnel;

Radio dispatch system:

- Main railway lines, regardless of train speed, as well as other railway lines for a train speed of 100 to 160 km/h, must be equipped with a radio dispatch system. The exact number and location of railway radio stations can be determined based on EM field measurements.
- Describe the necessary activities with stated costs for the measurement of the EM field and the preparation of the Elaborate of the measurement of the coverage of the track with the EM field of the radio-dispatching system and other necessary technical documentation required by the regulatory bodies for this type of device.
- The RD switchboard and railway radio stations shall be provided implemented in modern technology in accordance with traffic technology, and recommendations of UIC 751-3.
- Possibility of connecting the RD center and railway radio stations by copper pairs and optical fibers shall be provided.

Station telecommunication systems:

All stations and service points in scope of the project shall be equipped with the following telecommunication systems:

- Installation of a common communication network:
    - The installation of the common communication network should be carried out according to the principle of structural cabling. This means that computer and telephone sockets are the same, type RJ-45 minimum cat. 6. the layout of the RJ-45 sockets shall be adjusted according to the needs of the users.

- Railway automatic telephone network (ŽAT):
    - Provide a centralized VoIP telephony system for the communication of railway staff on the entire section of the railway. The VoIP telephony central device is planned at the location where the regional VoIP ŽAT switchboard is located, which should be dimensioned to accept all users of this section with the possibility of expansion. Provide local VoIP telephony devices at the location of the regional ŽAT switchboard. Enable independent operation of local devices if communication with the central device is interrupted. Connections with the existing ŽAT network can be made through the ŽAT headquarters in Belgrade, Nemanjina 6 street, in the office building of "Serbian railways infrastructure" jsc.
    - Keep the existing numbering applied in the ŽAT network. Provide in each station interface devices of appropriate capacity for connecting analog telephones to the VoIP system.

- Provide a monitoring system for monitoring/supervising the operation of the VoIP system with all its elements.
- VoIP switchboards must have the option of receiving SIP trunks or some new technology for connecting to the public telecommunications network of Telekom.
- Provide rack cabinets for placement of equipment as well as office furniture for placement of workstations.

– Clock System:

- Clock system designed on IP technology and equipment shall be provided. In all service points where this system is planned, install secondary IP clocks. The central equipment of the clock system is the master clock and GPS receiver in the station Belgrade center. Redundant "parent" clock with GPS receiver should be placed in a suitable station.
- Provide a monitoring system for monitoring/supervising the correct operation of the clock system with all its elements.
- Provide rack cabinets for equipment placement as well as office furniture for workstation placement.

– Public address system:

- Provide a modern digital public address system, which should work in both local and central mode. The local mode involves informing the passengers by the train dispatcher via the microphone console. Central mode implies system integration with central systems for providing information. The public address system should be connected to the integrated audio and visual passenger information system (AVIS). Through the AVIS system, the public address system announces predefined messages. Spaces and rooms where movement and stay of passengers is planned, must be equipped with loudspeakers. Provide a monitoring system for monitoring/supervising the correct operation of the public address system with all its elements.
- Provide rack cabinets for equipment placement as well as office furniture for workstation placement.

– Information board system:

- In service points in which this system is planned to be installed, IP information boards shall be placed. Provide a visual passenger information system based on IP technology and equipment. Information boards can be platform or separate collective (information boards for displaying the timetable for arrival and information boards for displaying the timetable for departure). The visual passenger information system should be connected to the existing AVIS system. Through the AVIS system, information boards display pre-defined messages.
- Provide a monitoring system for monitoring/supervising the correct operation of the information board system with all its elements.
- Provide rack cabinets for equipment placement as well as office furniture for workstation placement.
- Connect the system to the central database of IŽS for tracking the trains' operation.

– Business information system:

- The business information system consists of an intranet computer network, based on a structural cable system, for connecting the telephone system, data transmission system and other non-critical systems. Terminal endings should be defined with an RJ45 socket of

minimum category 6. The minimum number of connections per employee's workplace should be 3 or more depending on needs.

- The business information system should be supported with a server structure for the needs of the business information system.
- The server structure must be done according to the principle of virtualization and in accordance with the platforms used in the intranet network.
- The server structure should enable the operation of several servers necessary for network operation as well as for the operation of the business system, as well as have the option of storing backup data from critical workstations, employee workstations and servers.
- Connection shall be done by optical connections to all facilities in stations and interstation distances for connecting facilities and services along the railway for the purposes of connecting employees to the Intranet network and by copper structural cabling to all employees in station facilities.

– Transport system:
  - Equip the railway section with transport systems consisting of IP/MPLS systems for the transmission of non-critical services. Systems of non-critical services must be integrated into the intranet network of IŽS. Active equipment of non-critical systems (L2, L3, MPLS) must be located in IT premises.

### *3.5.10. Technical protection system*

Video surveillance shall include the following:

– IP system of video surveillance for the protection of critical locations (level crossings, SPEV, relay rooms, station space, passenger movement and other);

– Provide video surveillance on all level crossings with at least 3 cameras per crossing and remote access to the video surveillance device;

– Provide a video surveillance system based on IP technology and equipment. Enable recording, monitoring and review of recorded material, monitoring in real time, recording continuously and according to parameters. Secure the storage of recordings from the cameras for up to 30 days.

– Provide a monitoring system for monitoring/supervising the correct operation of the video surveillance system with all its elements.

– Provide rack cabinets for equipment placement as well as office furniture for workstation placement

### *3.5.11. Mechanical installations in station structures*

The design shall envisage the required mechanical installations in the structures (thermodynamic, water supply, air conditioning,…) in accordance with the structure purpose and the required technical and technological properties.

### *3.5.12. Operation and organization of traffic*

Within the Design, the following shall be processed for the above stated line section:

1. Volume of passenger and freight services for the previous period of 10 years;
2. Forecast of perspective volume of passenger and freight services of 20 years;
3. Technical description of current condition of railway line and service points' infrastructure capacities;

4. Analysis of the current condition railway line and service points' infrastructure capacities;
5. Analysis of the current operational technology;
6. Principles for organization of passenger and freight train operations on line after modernization;
7. Analysis of travelling duration and capacity of railway line and service points necessary for organization of train movement, transport of passengers and freight, based on the prospective volume of service, as well as the analysis of track capacities and occupation degree;
8. Traffic data gathered from analysis of traffic should serve as the basis for analyzing existing traffic trends and determining the patterns of development. This activity involves a detailed analysis of traffic parameters (number of passenger and freight trains per timetable, number of dispatched passengers per stations, freight traffic on the track, characteristics of public passenger transport, characteristics and traffic load of roads with traffic flow structure, unevenness in directions) in the gravitational area of the railway line. If the available data are not sufficiently covered by the traffic database, appropriate additional measurements should be conducted. Forecasts should be made for different scenarios of area and traffic development for a planning period of 20 years. The conclusions from the obtained results should be formulated in a way that is directly applicable for further design and CBA analysis.
9. Results and analyses from the above item shall be presented by using the modern software for railway simulation with a valid confirmation for commercial use;
10. Analysis of the required number of halts and platforms in the service points in relation to the expected volume of service and number of passengers as well as in relation to the population numbers in the catchment area;
11. Analysis and definitions for the most beneficial stations to have track lengnth(s) expanded to accomodate train lengths of 740 m;
12. Planned technology of operation at the service points and new joint border crossing station;
13. Defining of use of premises by services and station facilities;
14. Defining of movement of passengers, users and accompanying persons and directing towards the contents at service points with clearly marked information displays;
15. New Traffic technology and organization of transport on line after modernization;
16. Technology and organization of traffic during the execution of works which shall be reconciled with the proposed time schedule for the execution of works. Proposed time schedule and intervals for the execution of works must be approved by "Serbian Railways Infrastructure" JSC;
17. Summary of designed solutions for the civil engineering and electrotechnical infrastructure of railway line and service posts;
18. Graphical attachments in adequate scales, as well as linear layout of the designed railway line solution with signals and signal markings, station schemes in the existing and designed condition, designed train path plan, designed sectioning scheme and section (axle counter) plan;
19. Analysis of the need to change the service point status in accordance with the future volume of transport as well as proposal for closing or opening of new service points;
20. The required track capacities in stations and intersections, required number and length of platforms, required warehouse ramps in freight stations, service premises and passenger premises as well as the required passenger information equipment shall be determined from the traffic functioning aspect;

### *3.5.13. Technology and organization of the execution of works*

In addition to the basic content of this book, the Design shall envisage the locations of construction plateaus, if allowed by space conditions, access shall be provided by the existing railway line and road. Construction plateaus shall enable deployment, storing and passing of construction machinery whose use is envisaged in accordance with the Contract for the execution of works, for the entire duration of works.

Where local roads are used for access to construction site, the design shall check the carrying capacity of roads in question (in relation to heavy duty road traffic to be accepted by the road), required maintenance during the execution of works shall be envisaged as well as returning of road into the original condition after the completion of works on reconstruction of railway line.

The Design shall envisage connections to power sources (providing the necessary output) required for the execution of works. If the connection is not possible, use of diesel aggregates shall be envisaged.

The Design shall envisage temporary and permanent stockpiles for the material of all types obtained during the execution of works (permanent way and substructure materials, crushed stone, excavation material,…) on the local stock piles located at the distance of up to 20 km from the location of works; with obtaining of local municipalities approval for the use of the required surfaces. Furthermore, temporary storages for storing of new materials of all types required for the execution of works shall be also envisaged.

### *3.5.14. Feasibility Study*

Feasibility Study shall be made on the basis of the solutions from Preliminary Design and cost estimates from BoQ, previously approved by the Client, and in accordance with the Rulebook on the content and scope of previous works, Prefeasibility study and feasibility studies ("Official Gazette of RS", No. 1/2012) and shall determine, in particular, the spatial, environmental, social, financial, market and economic justification of the investment for the selected solution, developed by the Preliminary design.

Feasibility Study should describe in depth the preferred technical option for the Project considering all relevant aspects and conclusions, measures and recommendations documented in the national EIA and WB ESIA, and with Preliminary Design.

## 3.6. Environmental Impact Assessment Study

The Consultant is obliged to prepare the Environmental Impact Assessment study according to the Serbian regulation which will outline the main procedures and responsibilities to manage environmental and social risks associated with the implementation of the Project activities.

This shall include:

- Preparing the Request for determination of the scope and content, in accordance with the Rulebook on the content of the request on the need for impact assessment and the content of the request for determination of the scope and content of the Environmental Impact Assessment Study ("Official Gazette of RS", No. 69/05) and Law on Environmental Impact Assessment ("Official Gazette of RS", No. 94/24);
- Preparation of Environmental Impact Assessment Study;
- Participation in the procedure of adoption of the Environmental Impact Assessment Study, in accordance with the Law on Environmental Impact Assessment ("Official Gazette of RS", No. 135/04 and 36/09), Rulebook on the content of the Environmental Impact Assessment Study ("Official Gazette of RS", No. 69/05) and the Decision on determining the scope and content of the Environmental Impact Assessment Study issued by the competent body for Environmental protection;
- The Consultant is obliged to, timely and at its own expense, to eliminate all deficiencies in the Study on Environmental Impact Assessment, according to the findings of the competent authority that issues the consent to the subject study.

## 3.7. Environmental and Social Impact Assessment Study

The objectives of the task are to prepare Environmental and Social Impact Assessment Study (ESIA) for the Project, which will include guidance for developing specific mitigation, management, and action plans by the selected Contractor as per the requirements of the World Bank Environmental and Social Framework (ESF). The approved EIA will be basis for development of ESIA.

During project implementation, the final Design-Build contractor selected to undertake the Project will be responsible to implement ESMPs in line with the ESF requirements provided in the ESIA.

The preparation and processing of the ESIA will involve developing the required E&S instruments and may include as needed: site-specific/sub-project ESIAs, Environmental and Social Management Plans (ESMPs), Resettlement or livelihoods restoration plans, and Stakeholder Engagement Plans. Detailed ESMPs will be developed and implemented by the Contractor.

When Serbian regulations differ from the environmental protection standards of the World Bank ESF, WB EHSG, and GIIP (including European Union applicable regulation, directives and standards such as REACH, waste-related Directives and Guidelines e.g. for construction and demolition waste, nature protection related regulation, etc.) as well as Phase 1-level E&S documents guiding the overall project implementation (ESMF, LMP, SEP and RPF), the E&S instruments shall include and (ultimately) meet those that are stricter. These standards are listed in the links below:

- Environmental and Social Framework (ESF) - https://www.worldbank.org/en/projects-operations/environmental-and-social-framework
- WB EHSG - https://www.ifc.org/en/insights-reports/2000/general-environmental-health-and-safety-guidelines
- GIIP WB Good Practice Notes - https://www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-framework-resources#guidancenotes
- REACH – https://environment.ec.europa.eu/topics/chemicals/reach-regulation_en
- EU Waste protocols and Guidelines - https://single-market-economy.ec.europa.eu/news/eu-construction-and-demolition-waste-protocol-2018-09-18_en

The Consultant is expected to have a proficient understanding of the SRSM Phase 1 Project-level instruments. The final versions of these instruments, including the ESMF, Labor Management Procedure (LMP), Stakeholder Engagement Plan (SEP), and Resettlement Policy Framework (RPF), will be provided to the Consultant by the Client.

The ESIA and design outputs will inform each other within the defined boundaries of the SRSM Phase 1-level ESMF, and be otherwise aligned with the WB ESF. This includes, but is not limited to, excluding any designs that pose high environmental and social risks at any stage of the Project or that are not described in the Project description of this TOR.

The structure and templates of the site-specific E&S instruments are available in Annexes of the project ESMF (Provided by the MoCTI). Link to these is below:

https://www.mgsi.gov.rs/cir/dokumenti/public-consultation-enviromental-and-social-management-framework-project-level-stakeholder

## 3.8. Preparation of technical part of tender documentation for works contract documents

Within this task, the Consultant will prepare technical scope of Employers requirements and schedule of prices based on a template to be provided by the Client that will be part of the tender document.

# 4. CONTENT OF TECHNICAL DOCUMENTATION

Technical documents scope and volume shall be reconciled with the Law on Planning and Construction ("Official Gazette of RS", No. 72/221A9, 81/221A9 - corrigendum, 64/2010 - US decision, 24/2011, 121/2012, 42/2013 - US decision, 50/2013 - US decision, 98/2013 - US decision, 132/2014, 145/2014, 83/2018, 31/2019, 37/2019 - other law, 9/2020 ,and 52/2021 and 62/2023); Rulebook on the content, manner and procedure of preparation and manner of control of technical documentation according to the classes and purposes of the objects ("Official Gazette of RS", No. 73/2019), Law on Safety in Railway Traffic (Official Gazette of RS No 41/2018, 63/2023), Law on Railway System Interoperability (Official Gazette of RS No 41/2018) and other valid laws, regulations, rulebooks, instructions and standards concerning the subject matter of the given design.

The prepared technical documents shall consist of:

- General documents
- Textual documents
- Numerical documents and
- Graphic documents.

For the purposes of reconstruction and modernization of railway line the following content of technical documents shall be prepared, but not limited to the following:

- Preliminary Solution, for obtaining of Location Conditions;
- Geodetic documents;
- Geotechnical documents/studies;
- Design for railway line and service points alignment – substructure and permanent way;
- Design for bridges (bridges, viaducts, underpasses and overpasses);
- Design for upgrading of tracks on bridges;
- Design for structures up to 5,00 m span (culverts, etc.);
- Design for retaining walls, protective and other constructions;
- Design of tunnels
- Design for hydrotechnical structures;
- Design for roads;
- Design for architecture;
- Design for equipment for passenger informing and guidence;
- Design for protection and relocation of the existing technical and utility infrastructure;
- Designs for electrification;
- Design for signaling and interlocking facilities;
- Design for telecommunication and IT systems;
- Design for traffic technology and organization;
- Design for technology and organization of the execution of works;
- Design for traffic organization during the execution of works;
- Design for expropriation;
- Design for land subdivision;
- Design for technical environmental protection measures;
- Elaborate for fire protection;
- Synchronous plan (textual and graphic attachments);
- Feasibility Study;
- Environmental Impact Assessment Study;
- Environmental and Social Impact Assessment Study.

# 5. LOCATION AND TIMING

## 5.1. Location

During the project timeline, the Consultant is obliged to establish an operational base on his own premises. Regular meetings between the Client's and the Consultant's representatives shall be held on agreed locations.

## 5.2. Commencement date and period of implementation

The intended commencement date is June, 2025 but the actual commencement date will be defined with the signature of the Contract. The period of implementation of the Contract will be 18 months starting from the commencement date, but no later than 31 December 2026, as Project completion date.

# 6. CONSULTANT STAFF REQUIREMENTS

## 6.1. Personnel

The Consultant shall establish his Team in accordance with the needs and requirements of these ToR. The Team shall consist of a core team made of key experts with the qualifications and skills defined in the Table 2, below and non-key experts.

The Consultant is obliged to ensure adequate staff in terms of expertise and time allocation, as well as needed equipment in order to complete the activities required under the scope of work and to achieve the objectives of this Contract in terms of time, costs, and quality.

The Project language is English.

### *6.1.1. Key experts*

The team should include key experts with the qualifications and experience listed below, as well as non-key experts, if necessary, and as a minimum, the Consultant shall provide the following experts:

*Table 3: Key experts for the assignment*

| Title | Qualifications/Experience | Skills |
|---|---|---|
| Team Leader | Education:<br>Have as a minimum MSc Degree in civil engineering or another relevant field;<br>Relevant professional experience:<br>At least 15 years of general experience; at least 7 years of relevant experience in preparation technical documentation for the railway sector; Experience as a team leader/project manager /in successfully implemented at least 2 railway projects related to the designing of for (re) construction / rehabilitation of railway track. | Good knowledge of English language<br>Knowledge of Serbian language will be an advantage |
| Railway Civil Engineer | Education:<br>Have as a minimum MSc Degree in Civil engineering.<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of technical documentation for the railway sector. Participation in at least 2 projects in the last 7 years for railway infrastructure design for (re)construction / rehabilitation of public railway infrastructure<br>Valid license: 315 (or new licence number equivalent) | Knowledge of English. Knowledge of Serbian language will be an advantage |
| Railway structural engineer | Education:<br>Have as a minimum MSc Degree in Civil engineering.<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of technical documentation for the railway sector. Participation in at least 2 projects in the last 7 years for designs of construction or reconstruction of bridges on public railway infrastructure.<br>Valid license: 310 (or new licence number equivalent) | Knowledge of English. Knowledge of Serbian language will be an advantage |

| Title | Qualifications/Experience | Skills |
|---|---|---|
| Railway electrical engineer – OCL expert | Education:<br>Have as a minimum MSc Degree in electrotechnical engineering;<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of technical documentation for the railway sector. Participation in at least 2 projects in the last 7 years for railway infrastructure design for overhead contact line construction/reconstruction<br>Valid license: 350 or 351 (or new licence number equivalent) | Knowledge of English. Knowledge of Serbian language will be an advantage |
| Railway electrical engineer – Signalling and interlocking / telecommunication expert | Education:<br>Have as a minimum MSc Degree in electrotechnical engineering;<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of technical documentation for the railway sector. Participation in at least 2 projects in the last 7 years for railway infrastructure design for signalling, interlocking or telecommunication system installation or modernisation.<br>Valid license: 352 or 353 (or new licence number equivalent) | Knowledge of English. Knowledge of Serbian language will be an advantage |
| Railway operation expert | Education:<br>Have as a minimum MSc Degree in traffic and transport;<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of technical documentation for the railway sector. Participation in at least 2 projects in the last 7 years for railway infrastructure design for (re)construction/rehabilitation of railway as a traffic expert and /or responsible designer.<br>Valid license: 368 (or new licence number equivalent) | Knowledge of English. Knowledge of Serbian language will be an advantage |
| Spatial plans expert | Education:<br>Have as a minimum MSc Degree in spatial planning, engineering or equivalent;<br>Relevant Professional Experience:<br>Experience: at least 10 years of general experience; at least 7 years of relevant experience in preparation of spatial planning and urbanistic documentation.<br>Valid license: valid licence for responsible spatial and urbanistic planning | |

| Title | Qualifications/Experience | Skills |
|---|---|---|
| Environmental Expert | Education:<br>Have as a minimum MSc Degree in an environmental discipline or equivalent;<br>Relevant Professional Experience:<br>Minimum 7 years of professional experience in the environmental protection sector. Previous experience in the preparation of ESIA/EIA for transport infrastructure projects. Participation in the preparation of at least 1 ESIA/EIA studies for transport infrastructure-related projects. Knowledge of World Bank Safeguard practices will be considered as advantage | Knowledge of English. Knowledge of Serbian language will be an advantage |
| Feasibility Study Expert | Education:<br>Have as a minimum MSc Degree in traffic and transport or equivalent;<br>Relevant Professional Experience:<br>Minimum 10 years of general professional experience. Previous experience in the preparation of at least 2 Feasibility Studies for transport infrastructure projects. Participation in the preparation of Feasibility Study for transport infrastructure-related projects financed by the World Bank Group, will be considered as advantage | Knowledge of English. Knowledge of Serbian language will be an advantage |

### *6.1.2. Non - Key experts*

Non-key experts for Design in the following areas of expertise are foreseen, but not limited to:, Financial and Economic Expert, Tunneling Structural and other Civil engineers, Architectural engineer, Geotechnical engineer; Geodetic engineer; Electrical engineers, Mechanical engineer, Environmental specialists, Occupational Health and Safety Expert, Fire-protection Expert, Social Development and Safeguards Specialist, pool of Experts for the Spatial plans.

The Consultant must provide a detailed team structure that clearly indicates the profiles of the proposed experts.The pool of non-key experts is expected to support/complement all the activities of the key experts. Possession of relevant Serbian design license would be required, as applicable.

The Consultant is expected to include other positions considered necessary for the assignment in their proposals.

## 6.2. Office accommodation

Office accommodation for each expert working on the Contract is to be provided by the Consultant. The Consultant shall ensure that all key and non key experts are adequately supported and equipped.

# 7. DELIVERABLES AND OUTPUTS

## 7.1. Deliverable and Outputs requirements

The Consultant shall prepare, as a minimum, the below listed deliverables during the period of execution of the Contract.

*Table 4: List of deliverables*

| Deliverables | Description | Due date | Format |
|---|---|---|---|
| Inception Report | Describe the initial findings, progress in collecting data, any difficulties encountered or expected, the proposed approach, taking into consideration the situation at the starting date of the assignment. It will also set out a detailed work plan for completion of activities with Preliminary Program of geotechnical works. If there are any proposed modifications to the original ToR due to changed circumstances through information gathering activities, these are to be discussed and agreed in principle with the Client before the submission of the Report (up to 20 pages)<br>Subject to approval by the Client. | No later than 1 month after the commencement date | Digital and 4 hard copies in English and Serbian language |
| Draft Preliminary Solution | The analysis will identify main technical parameters to be reviewed and accepted by the Client, to serve as base parameters for subsequent design phase(s) and planning documents. The document will provide clear technical and technological solutions for the modernization of the railway line at an appropriate technical level.<br>Subject to approval of the Client. | No later than 3 months after the inception report | Digital in English and Serbian language |
| Program of geotechnical works | The program shall identify the locations, number and depth of excavation pits, collected samples and other geotechnical works per all laws, by-laws, standards and good engineering practices for this scope of designs.<br>The program shall include the sufficient number of samples and tests for all engineering structures, track substructure, buildings and borrow pits.<br>Subject to approval by the Client. | No later than 1 month after approval of Draft Preliminary Solution | Digital in English and Serbian language |
| Spatial plan for the special-purpose area | The Spatial plan for the special-purpose area of Infrastructure Corridor Ruma – Šabac – Donja Borina Junction – State border should be prepared in accordance with the Rulebook on the content, manner and procedure of preparation of spatial and urban planning documents ("Official Gazette of RS", No. 32 of May 3, 2019) and the need to obtain Location Conditions on a certain section of the railway line.<br>Subject to approval by MoCTI. | No later than 12 months from the date of the Decision on the preparation of the Spatial plan for the special-purpose area issued by MoCTI | Digital and 2 hard copies in Serbian language |
| Preliminary Solution | Preliminary Solution in terms of scope and content should be done in accordance with applicable laws, regulations, codes, instructions and standards that for subject of design.<br>Subject to approval of the Client | No later than 1 month from the adoption of Spatial plan for the special-purpose area | 4 printed copies in Serbian and 6 digital copies on a USB in Serbian and English |
| Feasibility Study with | Feasibility Study with Preliminary Design in terms of scope and content should be done in | No later than 3 months from the date of | 4 printed copies in Serbian and 6 digital |

| Deliverables | Description | Due date | Format |
|---|---|---|---|
| Preliminary Design | accordance with applicable laws, regulations, codes, instructions and standards that are the subject of designing.<br>Subject to pre-approval of the Client and approval of State Review Committee. | submission of the Location Conditions to the Consultant. | copies on a USB in Serbian and English |
| Environmental Impact Assessment Study | Environmental Impact Assessment Study should be done in accordance with Decision on determining the scope and content of the Environmental Impact Assessment Study issued by the competent body for Environmental protection and in accordance with applicable laws and regulations.<br>Subject to pre-approval of the Client and approval of the Ministry for Environmental Protection. | No later than 7 months from the date of issuance of the Location Conditions. | 3 printed copies and 3 digital copies on a USB on Serbian and English |
| ESIA | The Environmental and Social Impact Assessment Study will be prepared in accordance with WB standards, and compliant to all ESF Project instruments (Projects ESMF, LMP, SEP, RPF).<br>Subject to approval by the WB | No later than 1 months from the date of the approval of the EIA by Ministry | 3 printed copies and 3 digital copies on a USB on Serbian and English |
| Employers Requirements for bidding documents | Preparation of Employers Requirements that will be part of the design and build biding documents.<br>Subject to approval of the Client. | No later than 1 months from the date of the approval of the Preliminary Design by State Review Committee | Digital, Serbian and English |

The Consultant shall prepare, as a minimum, the below listed reporting documents during the period of execution of the Contract.

*Table 5: List of reporting documents*

| | | | |
|---|---|---|---|
| Minutes of meeting | The minutes of each meeting that was held between the Consultant and the Client's representative, with the main topics and conclusions of the meeting | Not later than 1 week after the end of meeting | Digital, Serbian and English |
| Quarterly Reports | Description of the level of completed documentation, possible problems and proposals for their solution, review of adopted designs and explained proposal for change. Monthly reports must also contain an overview of all receivables submitted by the Contractor since the beginning of the Contract. This overview should be made in a convenient form that allows consideration of requests, previous activities and key deadlines for resolving requests. (up to 20 pages). | Not later than 1 week after the end of month | Digital, Serbian and English |
| Final report | On completion of design and procurement documentation, the Consultant shall submit the final design report to Client. The final report contains:<br>– An overview/timeline of the actual progress of the contract/design detailing reasons for design delays and/or extensions of time<br>– All relevant conditions, approvals and permits presented in the design timeline | No later than 30 days after approval of drafted procurement documents. | Digital, Serbian and English |

| | | | |
|---|---|---|---|
| | – Details of design/technical difficulties encountered and how these were overcome.<br>– Details of administrative difficulties encountered and how these were overcome<br>An appraisal of the strengths and weaknesses in the contract documents (including but not limited to the, technical specifications, schedules, deadlines and design details) with recommendations on how improvements could be made for future contracts. | | |

## 7.2. Requirements for drawings and reports

The Consultant shall prepare and submit technical documents for the Client's approval, adhering to the requirements specified in the ToR and complying with all relevant laws, by-laws, standards, and good engineering practices. The Client reserves the right to reject any documents and designs deemed non-compliant.

The documents and drawings to be submitted by the Consultant shall take their final form after approval by the Client.

Design Documents and drawings shall be numbered systematically and the Consultant shall maintain an electronic register of all reports, documents and drawings to be used under the Contract.

Amendment and revision to any document shall be recorded and only the latest approved version shall be considered valid.

## 7.3. Submission and approval of outputs

All reports and other outputs shall be prepared and written bilingually, in Serbian and in English. The draft version of the reports (electronic copy, fully editable) shall be submitted to PIU for distribution to the MoCTI and SRI. The commenting period for the outputs is up to 3 weeks. In case of no-reaction to the submitted outputs such status will be interpreted as “no objection” and shall be deemed as approved.

Feasibility study with Preliminary design is subject to audit (expert control) of the State Review Committee and other competent and state bodies. Thus, the Consultant shall be obliged to, in a timely manner and at own costs, eliminate all deficiencies in the Preliminary Design with Feasibility Study, according to the findings of the State Review Committee and other competent and state bodies, and the authorized representative of the Client in order to obtain required approvals.

Environmental Impact Assessment Study is subject to audit (expert control) of the Ministy of Enviromental Protection. Consequently, the Consultant shall be obliged to, in a timely manner and at own costs, eliminate all deficiencies in the Environmental Impact Assessment Study according to findings of the Ministy of Enviromental Protection in order to obtain required approvals.

ESIA is subject of the review by the World Bank and Consultant shall be responsible for addressing all corrections in a timely manner and at the Consultant’s own expense to obtain the necessary approval.

The estimated review periods for the above-mentioned relevant authorities are as follows:

- Receiving a positive report of the State Review Committee: up to 3 months,
- Approval for the Environmental Impact Assessment Study: up to 3 months,
- Approval for the ESIA by the World Bank: up to 3 months,

These timelines are indicative and may vary depending on the complexity of the documentation and the review process.

All deliverables will be sent as electronic copies to PIU.

The Preliminary Design with Feasibility Study shall be prepared in both hard copies and electronic form, stored on a USB drive. The documentation on the USB must be identical to the printed copies in terms of presentation, content and order of data. All drawings, textual and graphic attachments submitted on the USB must be submitted in * .pdf format and in open files (* .doc, * .xls, * .dwg, * .mpp, ...) where at all situation models in the DWG format must be in the National (Spatial) Reference System.

Hard copies will be send to the following address PIU/MoCTI, Uzun Mirkova 3, 11000 Beograd, Republic of Serbia

The Consultant will, in order to successfully complete the project:

- For the purposes of obtaining Location conditions, in accordance with the applicable regulations and the Laws will act according to the orders of the competent institutions;
- For the purposes of obtaining a positive opinion of the State Review Committee for the expert control of technical documentation on the feasibility study with the Preliminary Design, in accordance with the applicable laws and regulations, will act according to the orders of the committee;
- In order to obtain a Decision on the acceptance of the Environmental Impact Assessment Study by the Ministry of Environmental Protection, it will act according to the orders of the Ministry;
- In order to obtain a Decision on the acceptance of the Environmental and Social Impact Assessment Study by the World Bank, it will act according to the orders of the World Bank.

# 8. TYPE OF CONTRACT

The Consultant should note that the proposed contract for this assignment will be as Lump Sum payments with milestones against submission of deliverables per Section 7, item 7.1, table 4.