Investor's Name:	Správa železnic, state organization.
Address including postal code:	Dlážděná 1003/7, 110 00 Praha 1 – Nové Město
ID No:	70 99 42 34
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Simplified documentation

Small-scale investment project: "Implementation of ETCS Regional Beroun - Nižbor"

1) Project identification data

Project number:	S632300008
Project name:	"Implementation of ETCS Regional Beroun - Nižbor"
Place of implementation (region):	Central Bohemian
Regional Directorate:	Prague
Operational district:	Beroun
TUDU code:	0761XX
Line:	Rakovník – Beroun
Track category:	R – regional track
Track section:	Beroun-Závodí - Nižbor
Track number according to TTP:	520 E
Track number according to official permission:	341
Track number according to timetable:	174
Type of track safety equipment:	Beroun-Závodí – Nižbor section: automatic line block Nižbor – Rakovník section: telephone communication
Braking distance:	700 m
Load class:	C3 (20 t/7.2 t)
Highest track speed:	70 km/h
Estimated implementation time:	07/2024 – 11/2024

Správa železnic, státní organizace
zapsána v obchodním rejstříku vedeném Městským soudem v Praze, spisová značka A 48384

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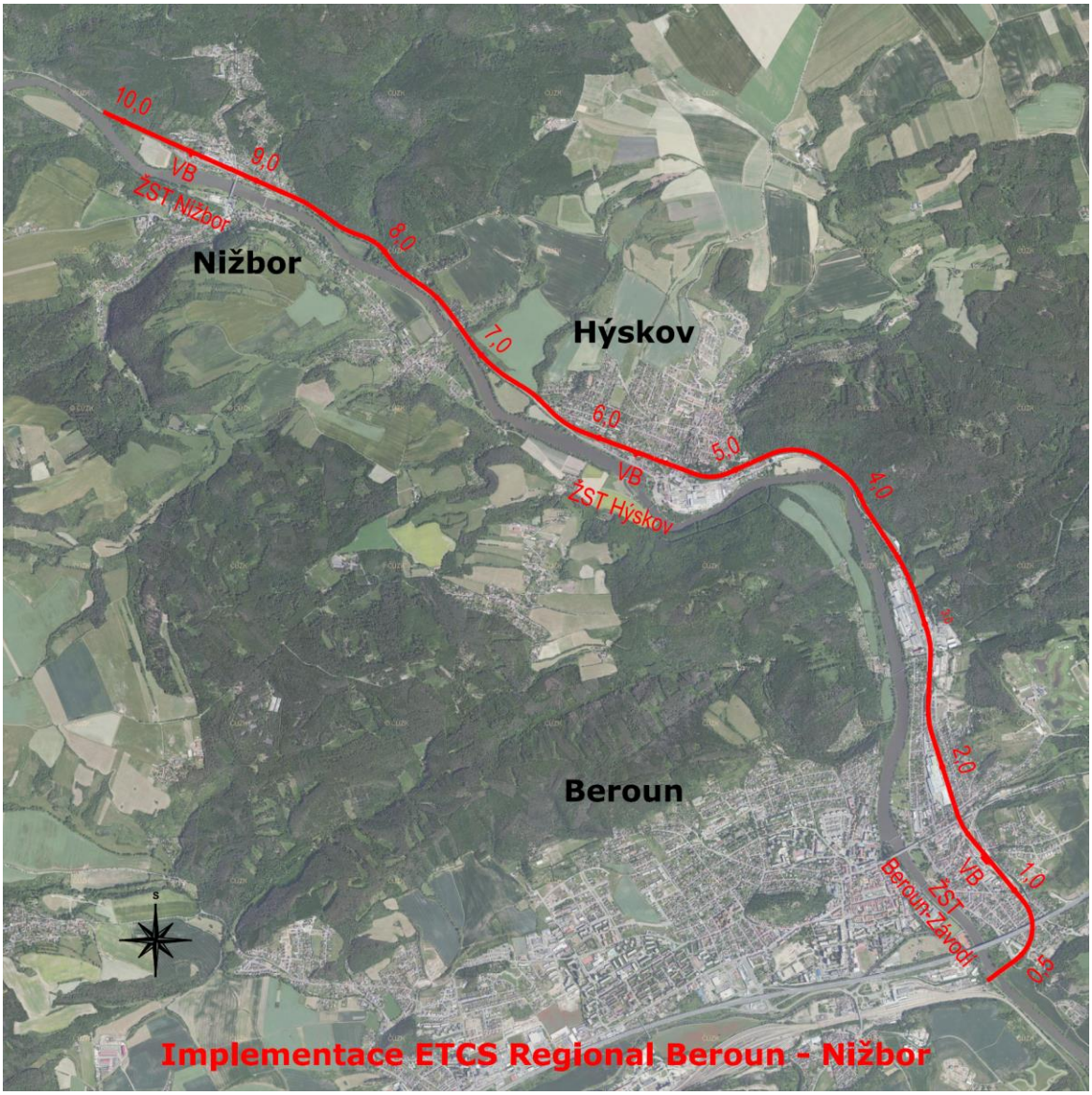
List of Abbreviations

ATO	Automatic Train Operation
BG	Balise Group
BNV	Balise Group with National Values
ČSN	Czech Technical Standard
DK	Railway Office
ETCS	European Train Control System
L1	Level 1
GŘ	General Directory
OŘ	Regional Directorate
LEU	Lineside Electronic Unit
MA	Movement Authority
PK	Packet
PZS	Level Crossing Protection System (with light indication)
PZZ	Level Crossing Protection System
RBC	ETCS Radio Block Center
SSZT	Communications and Interlocking Technology Administration
SÚ	Interlocking Center
SZZ	Station Interlocking System
TNŽ	Railway Technical Standard
TS	Technical Specification
TSI	Technical Specification for Interoperability
TSI CCS	TSI for Control and Protection Subsystems
TZZ	Line signaling system
ŽST	Train Station
RD	Relay shed
HW	Hardware
SW	Software
CIN	Total Investment Costs

2) Justification of the necessity of the investment project



The purpose of the construction is the pilot verification of the deployed technology in the conditions of the Czech railway network in cooperation with vehicles equipped with OBU, and also to increase the safety of operation in the track.

The construction fulfills the conceptual material of the Ministry of Transport "Plan of modern security of the Czech railway. Implementation of the European train protection system ETCS" from 2021.

3) Description of the technical solution

Current state

The beginning of the construction is at the home signal "L" at Beroun Závodí train station, where there will also be an interface between ETCS L1 LS and ETCS L2 (built within the construction of the III corridor). The end of the construction is approximately 600 m before the distance signal "PřL" at Nižbor train station. The interstation section Beroun-Závodí – Hýskov is equipped with TZZ 3rd category – AHP-03. In this interstation section, there are the following level crossings:

- P 2314 located at km 2.303, type PZS 3SBI
- P 2315 located at km 2.855, type PZS 3SBI
- P 2316 located at km 3.271, type PZS 3SBI
- P 2317 located at km 4.969, type PZS 3SBI

At Hýskov train station, SZZ 3rd category is installed – relay interlocking system AŽD 71. In railway station, there are the following PZZ:

- P 2318 located at km 5.434, type PZS 3SBI
- P 2319 located at km 6.431, type PZS 3ZBI

The interstation section Nižbor – Hýskov is equipped with TZZ 3rd category – AH 88. At Nižbor train station, SZZ 3rd category is installed – relay interlocking system AŽD 71. In this railway station, there is the level crossing P 2320 located at km 9.151, type PZS 3ZBLI.

Currently, there is no ETCS installed on the line, only an automatic entry into the ETCS L2 area is established at the home signal "L" at Beroun-Závodí train station. The line is controlled according to the regulation SŽ D1 PART ONE. Nižbor and Hýskov stations are permanently staffed by dispatchers who control the stations locally.

Local radio communication is implemented in MRS and TRS networks.

New state

Subject of the construction

The subject of the construction is the building and implementation of the train protection system ETCS L1 LS in the track section Beroun-Závodí – Nižbor according to the set of specifications no. 3.6.0, system version 2.1. In general, the construction of the ETCS L1 LS train protection system can be summarized in the following points:

1. Installation of new switchable and non-switchable balises
2. Installation of trackside electronic units (LEU)
3. Construction of new cabling for powering LEUs
4. Construction of new cabling for connecting LEUs to switchable balises
5. Construction of power sources in existing interlocking centers
6. Completion of the existing SZZ in Hýskov and Nižbor stations by adding the necessary cabling and power supply
7. Creation of telegrams for the track part ETCS L1 LS in accordance with the requirements of SŽ O14, ETCS and modern technology department

The proposed technical solution has been pre-discussed with the affected GŘ and OŘ departments and is in accordance with the document "Conditions and technical requirements for the preparation or implementation of the ETCS level 1 track part in Limited Supervision mode", ref. no. 78058/2022-SŽ-GŘ-O14 dated 15.12.2022.

The location of switchable and non-switchable balises and track electronic units (LEU), including a schematic representation of the construction of new cabling, is in Annex No. 1 "ETCS L1 LS scheme on the Beroun-Závodí – Nižbor line", which is part of this tender documentation.

Technical solution of LEU

A decentralized variant of LEU location was chosen for the design of LEU positions, i.e., placing the LEU at the signal location. The installation of the LEU on the signal pole is assumed so that they do not interfere with the clearance gauge of adjacent tracks. The maximum permissible dimension of the box for placing the LEU is 80 x 40 x 120 cm (w x d x h). The pre-agreed LEU placement proposal is shown in Annex No. 1 "ETCS L1 LS scheme on the Beroun-Závodí – Nižbor line" to this tender documentation.

The delivery of the LEU will also include all necessary HW and SW equipment for changing the LEU configuration.

The LEU supplier will enable the connection of the LEU to a diagnostic tool, which will allow monitoring the state of all relevant LEU states, including the state of all inputs.

LEU power supply

In Hýskov and Nižbor train stations, free pairs between the interlocking center and the home signals "L" and "S" at both station head can be considered for powering the LEU. From the existing departure signals further to the distance signal, there is usually only 1 free pair at both haed of both stations, and that is still on older cabling.

For powering the LEU, the existing free cabling of the security equipment, which is already built in Hýskov and Nižbor train stations, will be used to the maximum extent possible. For reliability reasons, we propose the construction of new cabling for powering the LEU in Hýskov and Nižbor train stations, in the section from the existing home signals at both station head to the distance signal.

To power the LEU, it is necessary to consider supplementing 48V DC power sources in the SÚ ŽST Hýskov and Nižbor and RD PZS P 2315 (DC/DC converter 24V/48V, up to 400W). In total, 6 power sources are considered, with two in hot backup. SZZ in ŽST Nižbor and Hýskov and PZZ P 2315 will also ensure the operation of the LEU for at least 3 hours.

Cabling

The anticipated design of the new cabling can be found in Annex No. 1 "Scheme of ETCS L1 LS on the Beroun-Závodí - Nižbor line".

For communication between switchable balises and LEU, it is necessary to build completely new cabling (e.g., type PEALT-CLT 1x4x1.5).

The extent of the new cabling, which will provide communication between the LEU and balises, is evident from Annex No. 1 "Scheme of ETCS L1 LS on the Beroun-Závodí - Nižbor line". The new cabling (both power and communication with balises) will be placed in the existing cable routes as an add-on. It is necessary to consider reserve pairs for the new cabling as well.

Connection to Signaling Systems

The proposed solution is connected to the SZZ, with the LEU located near the signals (distant signals) of the station being connected to the signaling circuit of the specific signal (distant signal).

The proposed solution is connected to PZZ P2315 between ŽST Hýskov and ŽST Beroun-Závodí. The LEU located in the relay shed will be connected to the logic of this PZZ for standby, non-annulling, and non-closure states.

To connect the LEU to the signaling circuits and PZZ, it is necessary to ensure a safety assessment report in the sense of ČSN EN50129 standard prepared by an independent safety

assessor on non-influence on signaling circuits and non-influence on PZZ logic, or possibly an assessment according to the implementing regulation of the commission no. 402/2013.

Control of Switchable Balises

Individual switchable balises will transmit telegrams depending on the signal aspects of a given signal or the state of the PZZ. In case of LEU failure or loss of communication between switchable balises and LEU, the switchable balise will transmit a predefined (default) telegram.

Balise Groups and Mounting

Side protection of balises is preferred. The proposal assumes that other technologies will be used for attaching balises, other than mounting on the rail base or mounting requiring tightening of screws and clamps. As part of the design documentation, direct attachment of the balise to the sleeper will be examined the current state of sleepers.

The delivery will include spare balises and mounting kits in the quantity of 6 pieces.

The delivery will include inhibiting balise covers of 10 pieces.

Non-Portable Signals for ETCS

As part of the construction, non-portable ETCS signals "ETCS Level Change" and "Exit Boundary of ETCS Area" will be installed in accordance with Annex No. 1 to this documentation "ETCS L1 LS scheme on the Beroun-Závodí – Nižbor line".

Trackside Approval

The documentation is subject to the Trackside Approval process, i.e., approval of the trackside part by the European Union Agency for Railways (ERA) according to the European Parliament and Council Directive (EU) 2016/797, as amended. Part of the contractor's performance is filling out the documents for Trackside Approval (see 4.1.8) and updating the affected parts of the design documentation according to the requirements and comments of ERA.¨

Equipment for Laboratory Purposes SŽ O14

Two decentralized LEUs will be supplied separately for laboratory purposes in the same technical design as those supplied for the subject construction.

The contractor will provide technical documentation for the testing and maintenance of the LEU and documents for supplementing the ZDD according to SSZT requirements before activation.

4) Object Composition

PS 01-01-71 PZZ P2315, ETCS

PS 02-01-71 ŽST Hýskov, ETCS

PS 03-01-71 ŽST Nižbor, ETCS

SO 01-86-01 PZZ P2315, ETCS power supply

SO 02-86-01 ŽST Hýskov, ETCS power supply

SO 03-86-01 ŽST Nižbor, ETCS power supply

PS 01-01-71 PZZ P2315, ETCS

The operational documentation set will describe the installation of the LEU and 2 balise groups at the railway crossing P2315, which is located on the busy class II road II/118. The LEU will be located in the relay shet and powered by the existing railway crossing system.

Power supply for the LEU will be describe in a separate construction object (SO).

SO 01-86-01 PZZ P2315, ETCS power supply

The construction object will desribe the power supply for the LEU at the PZZ P2315 crossing, including the construction of new cable sections in areas. This LEU will be powered by same source as level crossing P2315.

PS 02-01-71 ŽST Hýskov, ETCS

The operational documentation set will describe the installation of LEU units, balises and balises groups at ŽST Hýskov from the distance signal PřS to distance signal PřL. The operational documentation set also includes the construction of new cabling between the LEU and the switchable balise. The power supply for the LEU is desribe in a separate construction object (SO).

SO 02-86-01 ŽST Hýskov, ETCS power supply

The construction object describe the power supply for the LEU at ŽST Hýskov, including the construction of new cable sections in the areas of distance signal PrL to home signal L and distance signal PřS to homa signal S and the construction of a power source in the Hýskov station. The SO will also include any construction modifications in the Hýskov station.

PS 03-01-71 ŽST Nižbor, ETCS

Similar to the operational documentation set in Hýskov, this operational documentation set will describe the installation of LEU, balises, and balises groups at ŽST Nižbor from the distance signal PřS to distance signal PřL. The operational documentation set also includes the construction of new cabling between the LEU and the switchable balise. The power supply for the LEU is describe in a separate construction object (SO).

SO 03-86-01 ŽST Nižbor, ETCS power supply

The construction object desribe the power supply for the LEU at ŽST Nižbor, including the construction of new cable sections in the areas of distance signal PrL to home signal L and distance signal PřS to home signal S and the construction of a power source in the Nižbor station. The SO will also include any construction modifications in the Nižbor station.

5) Situation scheme ETCS L1 LS

The situation scheme is in a separate attachment no. 1 "Scheme ETCS L1 LS on the Beroun-Závodí – Nižbor track" to this tender documentation.

6) Zone and technical conditions

As part of the "Implementation of ETCS Regional Beroun - Nižbor" construction, only technological adjustments will be made to the existing equipment. All construction and assembly work will take place exclusively in the area of the already operated track. All work will not affect the surrounding environment.

The construction will not significantly affect the environment in the immediate vicinity.

The construction does not cause any relocation of existing engineering networks, does not impose restrictions on existing buildings, and does not require tree felling, except for self-seeding greenery. New cabling will be solved as an "opportunity" for existing cabling. The routing of existing cabling is available at the OŘ Praha SSZT.

7) Estimate of investment costs, including its justification

Total investment costs were estimated based on an expert estimate based on the scope of construction. Based on the estimate, we assume that the price will not exceed CZK 30 million.

Table CIN:

Cost allocation	Total costs [CZK]
1. Fees for plans/construction project	2 078 725
2. Land purchase	0
3. Construction	24 037 210
4. Machinery and equipment	0
5. Unforeseen events	2 332 822
6. Price adjustment (if necessary)	0
7. Promotion	50 000
8. Supervision during construction	192 114
9. Technical assistance	272 870
10. Subtotal	**28 963 741**
11. VAT	6 082 386
12. TOTAL	35 046 127

Total investment costs (CÚ 2023).

8) The economic evaluation

The economic evaluation was prepared using a simplified multi-criteria analysis for the economic evaluation of ERTMS constructions based on the valid Implementation Instructions for Evaluating the Efficiency of Transport Infrastructure Projects from November 15, 2017. This procedure is stated in Chapter IV. Different procedures, item 1 g).

The evaluation was prepared in the prescribed application in Microsoft Excel format. This file is an attachment to this economic evaluation and provides a more detailed justification for the project evaluation and the awarding of points in individual criteria.

The project met 3 exclusion rules because:

- It includes only the supply and installation of variable balises, LEU, and the necessary interlocking and communication cabling.
- In the "Transport Service Plan for the Central Bohemian Region for the period 2021 - 2025" (StČk, 12. 2020), the track is described in chap. 3.2.2.37, and both medium-term (until 2025) and long-term (after 2025) operation in the basic 60/60 interval with local reinforcements during transport peaks is stated.
- It scored 4 points in category 1 and 2 points in category 2.

In the point evaluation, the project scored points in the following criteria:

- 4 points for material adequacy because, according to the "Plan for Modern Interlocking of Czech Railways" (MD, 2021), ETCS implementation is considered on the Beroun-Závodí – Rakovník track in 2027, ETCS only operation in 2029, and ETCS L1 LS level. According to the material from the ERTMS/ETCS Implementation Program Steering Committee at SŽ from December 16, 2020, GSM-R construction is planned on this track between 2031 – 2034. In the 2023 timetable, an average of 14.9 pairs of passenger trains run daily on the track, as well as freight trains.

- 4 points for cost adequacy because the implementation costs (CZK 23.58 million) are 17.79% lower than the standard valuation.

- 2 points for continuity with the track already equipped with ETCS because the "ETCS Beroun – Plzeň" construction follows in Beroun station, which has been in trial operation since 11/2022 in the Beroun – Plzeň (excluding) section and is expected to be completed in 2023.

- 2 points for increasing railway traffic safety because ETCS L1 LS simplistically monitors train braking to the Stop signal, ensures emergency braking in case of passing a prohibiting signal, and monitors the limited number of speed profiles not exceeding the allowed speed.

The evaluated project met all exclusion criteria and scored 12 points in the point evaluation, which means that it exceeded the minimum point limit of 9 points needed for the economic justifiability of the project.

Based on the above information and the attached multi-criteria analysis evaluation file, the project in this form can be recommended for implementation.

9) Conclusion

This simplified documentation at stage 2 serves as a basis for approval and assignment of a small-scale investment project within the Railway Administration, a state organization.

Date: April 3, 2023

Prepared by:

Technical part: Ing. Peter Lastovecký, team of O6 and O14

Economic part: Ing. Petr Kratochvíl, Ing. David Kokojan

Attachments

Attachment No. 1 - ETCS L1 LS scheme on the Beroun-Závodí – Nižbor track
Attachment No. 2 – MKA_ETCS L1 LS Beroun - Nižbor