Basic information on the TMS Control Level for HSL Procurement

1. Basic information about the project

The construction of high-speed lines is a long-term strategic project for the development of transport infrastructure in the Czech Republic. The high-speed network will have a total length of approximately 700 km and will be divided into multiple investments. Their implementation will bring state-of-the-art innovations in rail transport, which will require a new traffic management system, coordination between different operating systems and interfacing between high-speed lines and conventional lines.

HSL construction is planned for 2028-2050, which places high demands on the scalability of the traffic management system and its ability to gradually connect new sections.

The construction of individual sections can be implemented through various financing models, including private-public partnership (PPP) projects.

The Traffic Management System (TMS) Control Level will be located in two locations: in new traffic control centres ("CDP") in Prague on the premises of approx. 520 sqm and in Přerov on the premises of approx. 240 sqm, with redundant fibre-optic cable connection between these two centres. The connection between the TMS centres will be first implemented through fibre-optic cabling of the conventional railway network and, during the gradual construction of HSL sections, through a new fibre-optic network to be established along the high-speed sections.

The TMS Control Level for HSL will control two main areas. Appendix No. 5 – HSL Section Description Tables provides an idea of the organisational arrangement of HSL traffic control, an overview of individual sections including their length and the number of turnouts served in the given section. It also lists the number of controller's workplaces responsible for line, traffic and power supply control. Backup workstations are also part of each HSL traffic control centre hall to ensure uninterrupted operation in case of emergencies. The details are described in Appendix No. 3 – HSL Traffic Management Concept.

Figure 1 is a map showing the scope of the TMS Control Level procurement for HSL. The individual sections controlled by the TMS Control Level are marked in red and purple. The lines connecting HSL and the conventional rail network (exits from and entries to HSL) are also shown. Each of these areas covers several sections of the line and the system will ensure their complete management and coordination within the operation of high-speed rail.

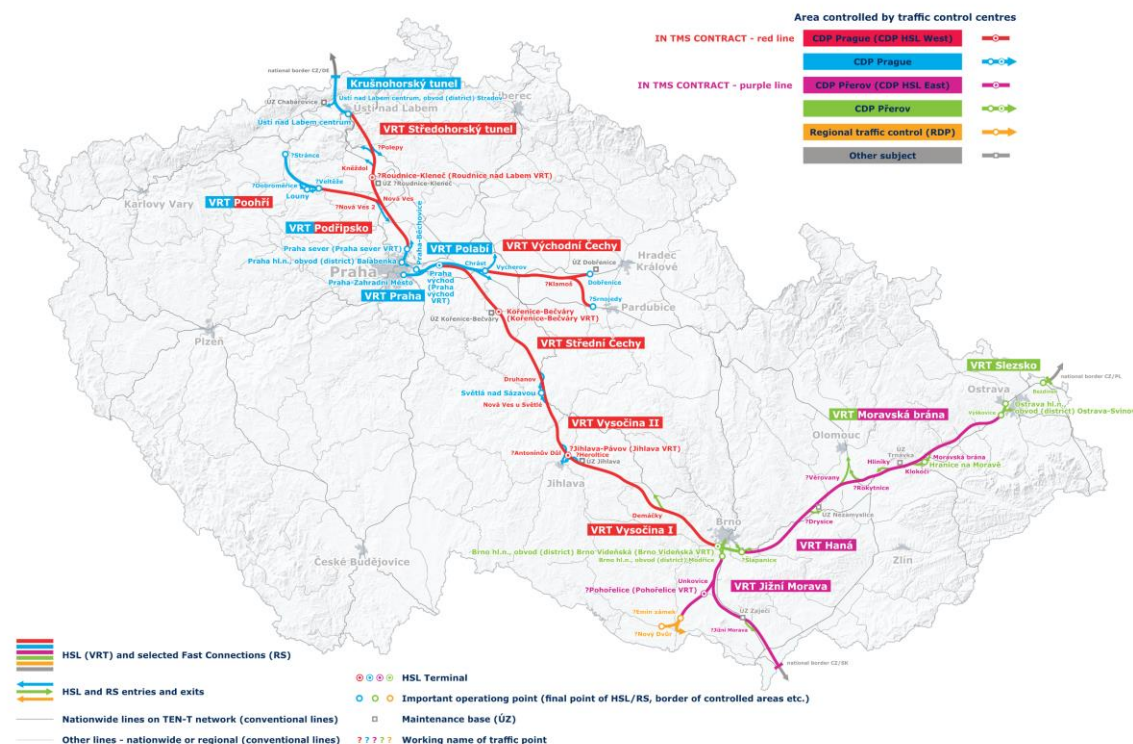**MAP OF CONTROLLED HSL SECTIONS AND SELECTED FAST CONNECTION (RS) SECTIONS**

Figure 1: Map of controlled HSL sections and selected Fast Connection (RS) sections (the procurement includes the red and purple areas/sections)

VRT CDP Praha (HSL Prague traffic control centre)	VRT CDP Přerov (HSL Přerov traffic control centre)
VRT Vysočina I (HSL Highlands I)	VRT Jižní Morava (HSL South Moravia)
VRT Vysočina II (HSL Highlands II)	VRT Moravská brána (HSL Moravian Gate)
VRT Střední Čechy (HSL Central Bohemia)	VRT Haná (HSL Haná Region)
VRT Východní Čechy (HSL East Bohemia)	
VRT Podřipsko (HSL Říp Flatlands)	
VRT Poohří (HSL Eger Flatlands)	
VRT Středohorský tunel (HSL Central Uplands Tunnel)	

Table 1: Sections controlled within the procurement "TMS Control Level for HSL"

The concept of automatic HSL operation in the Czech Republic is divided into 3 levels: see Figure 2 and Appendix No. 3 – HSL Traffic Management Concept. The division of responsibilities for design, implementation, maintenance and operation is shown in Table 2.

TMS level	design, implementation, maintenance	operation
Level 1	**TMS Control Level for HSL Procurement**	Správa železnic
Level 2 and 3	Part of the HSL procurement	HSL operator

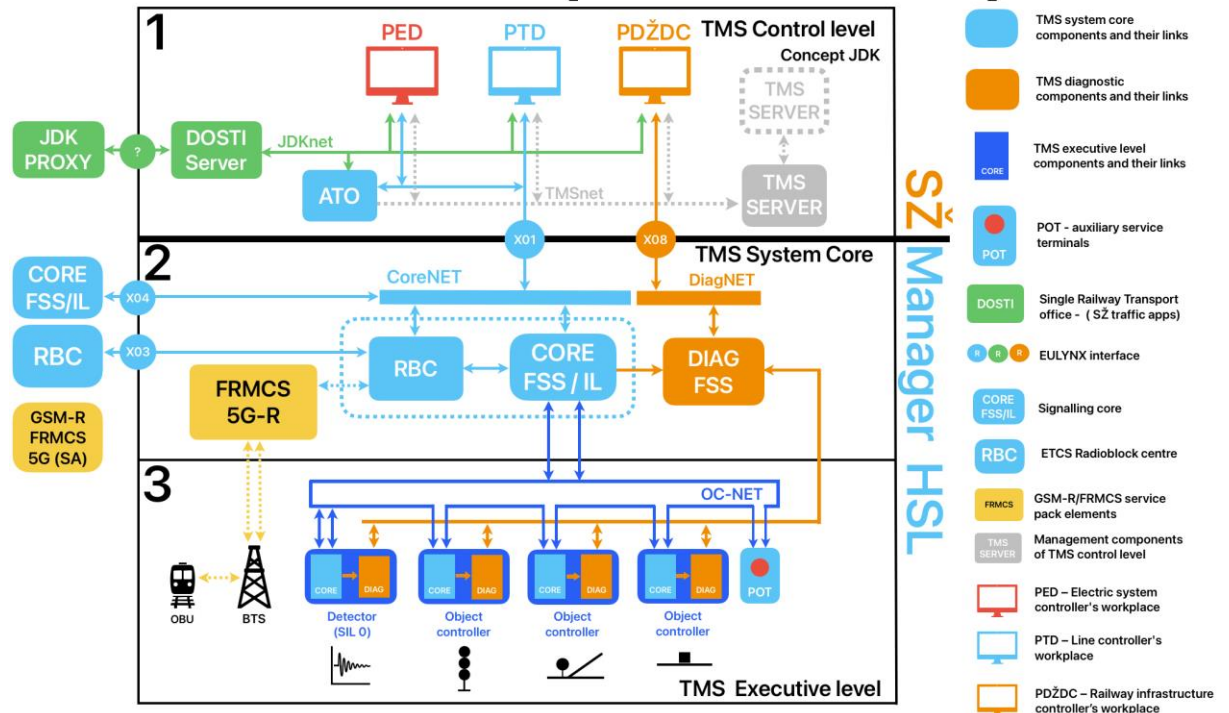Table 2: Division of responsibilities within each level of TMS

Figure 2: HSL automatic operation concept

The subject of the contract is the design, implementation and maintenance of the TMS Control Level for HSL (Level 1), which is shown separately in Figure 3.
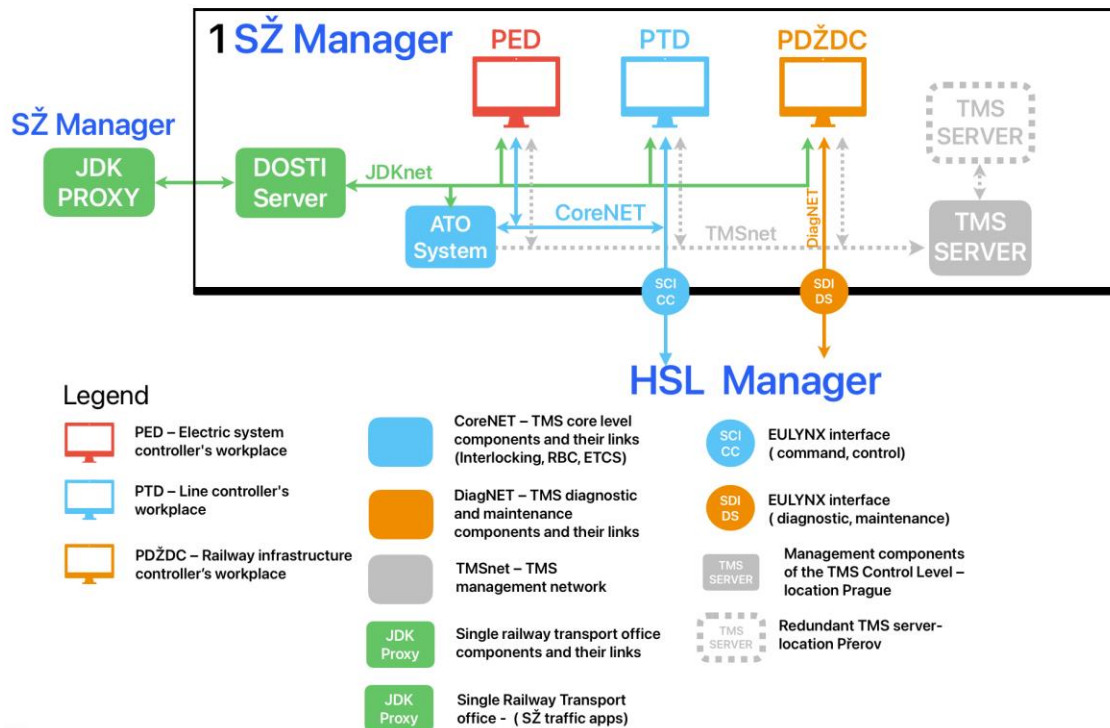

Figure 3: Procurement: TMS Control Level for HSL

2. The TMS Control Level for HSL includes:

Interconnection between individual services and traffic controller's workplaces – the system integrates the workplaces of the electrical controller (PED), the line controller (PTD) and the railway infrastructure controller (PDŽDC). These integrated workplaces are managed through a TMS server.

The use of communication and control networks such as:

a) JDK Proxy & DOSTI Server for operating applications – of which the DOSTI Server will connect the Správa železnic Manager with the TMS system.
b) CoreNET – connects key elements of TMS (e.g. Interlocking, RBC, ETCS, radio).
c) TMSnet – network for TMS management.
d) DiagNET – diagnostics and maintenance network for TMS.
e) JDKnet – Single Railway Transport Office (JDK) network for operating applications.

The integration of the Automatic Train Operation (ATO) system into the TMS is required as part of the traffic control automation.

Use of EULYNX between TMS and the HSL Manager, in particular the SCI-CC interface and the SDI-D (diagnostics and maintenance) interface.

Management description:

a) Správa železnic Manager – responsible for TMS and integration with existing transport applications (via JDK Proxy) in the scope of Level 1 (see Figure 2).
b) HSL Manager – responsible for the failure-free condition of HSL infrastructure (RBC, control panels, object controllers, cabling, etc.) in the scope of Levels 2 and 3 (see Figure 2).

TMS has its main server in Prague and Přerov. In the event of a failure, one of them serves as a hot backup between each other.

3. Minimum requirements for TMS

HSL operation will be fully automated, with interventions of traffic controllers kept to a minimum. The TMS must ensure seamless management of rail traffic with automated route planning, optimisation of timetables and dynamic adaptation of operating conditions. Supervision by traffic controllers will be primarily focused on emergency situations, crisis management of railway transport and manual interventions in case of emergencies.

TMS will be fully compatible with ETCS Level 2, with the possibility of ETCS Level 2 with hybrid train detection expected in some sections. We require the system to be adaptable to new technological solutions that may emerge in the future.

Scalability and long-term sustainability: the system must allow for gradual expansion in line with gradual HSL construction.

Immediate redundancy – in the event of a failure of one site, the other site must automatically and take over control without delay.

HSL is operated in the ETCS-only operation mode (L2 B4R1 4.0.0 or later) and ETCS Emergency operation.

It is forbidden to enter any HSL without a functioning mobile part (OBU) of the ETCS.

Interfacing with various Level 2 and Level 3 alarm vendors (see Figure 2) – either integration via the EULYNX standard or a commitment from the TMS Control Level vendor to ensure compatibility with at least three other manufacturers is expected.

HSL operation is only possible via train routes, train routes according to local sight conditions, or train routes with limited speed.

In case of any failure where all the conditions for the FS (Full Supervision mode) are not met, the maximum permissible speed is 60 km/h (this speed limit must be provided by the ETCS for trains with an operational mobile part (OBU) of the ETCS). The maximum permissible speed is 40 km/h within the perimeter of an operating control point with track branching.

No risk functions are set up within the TMS control from the traffic control centre (CDP).

No emergency operation or subsidiary signals are considered on HSL.

HSL operation is fully automated through the TMS and its subsystems during operation (approx. 5:00-23:00) and during the operational break (approx. 23:00-5:00 in accordance with the Decree No. 177/1995 Coll. of the Ministry of Transport). The management mode may differ in both cases.

In the event of an ETCS failure or shutdown during the traffic break, maintenance in HSL tracks is forbidden.

In case of a fault, an ETCS track-side shutdown and/or if the track section in front of the ETCS Stop sign is occupied and the RBC has no information that it is occupied by a train in FS mode in the direction of travel to the ETCS Stop sign, the Stop sign and Train ride permitted signals shall be lit automatically on the ETCS Stop sign lamps when the conditions for the train route are met.

TMS enables, through its subsystems (ATO, FRMCS, CCS, TCS...), automatic passage of trains according to applicable timetable with the possibility of intervention by the line controller in case of a change in the time position of the train (so-called slot).

All train rides within HSL are scheduled in advance via the Timetable into time slots so as to ensure the most efficient HSL utilisation. A change in the time slot must not affect any other train. Train delays are the responsibility of the component that caused such an irregularity.

HSL operation suspension without any conditions agreed in advance with the line controller is also considered an extraordinary event. Such reasons may include infrastructure failures or faults as well as an extraordinary stoppage of a railway vehicle.

For this reason, single continuous archiving of all TMS equipment and controllers' work must be established for a minimum of 18 months. The system will allow not only access to but also work with these archive records. Archived data will be backed up in at least two different ways.

The architecture of the Executive Part of TMS is designed in such a way that a fault in one line track stops traffic only in that track. Traffic continues on the side track. If necessary, at least at a reduced speed.

The TMS must respect the principles of cyber security defined by applicable EU and Czech legislation and internal regulations of Správa železnic.

In the event of a cyber-attack on the TMS, the TMS must respond in a secure manner and immediately cease operations. After construction completion of CDP VRT (HSL) Přerov and CDP VRT (HSL) Prague and in the event of a cyberattack on any of these CDP TMS for HSL, the TMS must also react in a safe manner and immediately close the CDP that has been attacked from operation control.

Trains stranded in tunnels or bridges can continue like in ETCS failure mode to the nearest suitable stopping point following an agreement with the line controller.

TMS will be connected to the internal closed Správa železnic network. It will respect all network management and configuration rules. All possible network elements will be compatible with existing Správa železnic network elements, where the management, supervision and configuration will be in the competence of Správa železnic.