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TRANS-BORDER PILOT ERTMS SECTIONS KATOWICE - BOHUMIN – PROPOSAL

The paper presents the proposal of a pilot section for ERTMS system. Discussed are conditions and necessity to implement the ERTMS on PKP. The existing condition of infrastructure on the line Katowice - Bohumin and its basic technical data are described. A proposal is made how to implement ERTMS with regard to the migration to the existing railway traffic control system. Also a likely implementation schedule is shown.

TRANSGRANICZNY ODCINEK PILOTOWY ERTMS KATOWICE - BOHUMIN – PROPOZYCJA

W artykule przedstawiono propozycję odcinka pilotowego dla systemu ERTMS. Omówiono uwarunkowania i konieczność wdrażania ERTMS na PKP. Opisano stan istniejącego wyposażenia linii Katowice- Bohumin oraz jej podstawowe dane techniczne. Zaproponowano sposób wdrażania ERTMS z uwzględnieniem migracji do systemu istniejących urządzeń srk. Pokazano również możliwy harmonogram wdrażania.

1. INTRODUCTION

The basic condition enforcing use of ERTMS/ETCS system in Polish State Railways are the following legal acts:

- Directive UE 91/440/EC of 29 June 1991 „On development of Community's railways",
- Directive UE 96/48/EC of 23 July 1996. „On interoperability of Trans-European high speed railway system",
- Directive UE 2001/16/EC of 19 March 2001 „On interoperability of Trans-European conventional railway system".

Directives 96/48/EC i 2001/16/EC impose on states members of EU the obligation to ensure railway interoperability. It has to be realized also through implementation for operation of the ERTMS system consisting of ETCS and GSM- component. The requirements for ETCS and GSM - systems are contained in the UE Decision 2001/260/EC

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of 21 March 2001. „On basic control system parameters" supplementing the Directive 96/48.

Failure to observe the decisions contained in the directives will result in the following basic repercussions:

- Enforcing of ERTMS implementation by EU authorities,
- Transfer of passenger and cargo traffic towards the railways that fulfill the requirements (for example in the neighbour countries),
- Much lower charges for making the line available for transport performed by foreign forwarders,
- Lower safety on PKP lines in comparison to other railway managements.

All European lines are implementing the ERTMS/ETCS systems. They are followed by other railways (for example India and South Africa). These experiences encourage implementation of ERTMS/ETCS on PKP with pilot installations.

Moreover, the following argumentation supports this solution:

- Necessity to adapt the PKP's rolling stock (locomotives) to ETCS,
- Necessity to check the ETCS cooperation with the rolling stock remaining in the PKP inventory (this applies above all to the locomotive equipment),
- Development and check of STM to SHP and Radiostop,
- Development and testing of interfaces between the railway traffic control equipment remaining in operation and the trackside ETCS equipment,
- Gaining experience with construction and operation of GSM- R,
- Gaining experience in installation of ERTMS/ETCS equipment,
- A possibility to perform homologation of ERTMS devices before their introduction to common operation,
- Gaining preliminary operational experiences with ERTMS.

2. PILOT SECTION KATOWICE - BOHUMIN

The proposed section (Fig.1.) is a fragment of VI transport channel in the transport lane E- 65 Gdynia – Warszawa – Rijeka, covered by the European Contract AGC and AGTC.

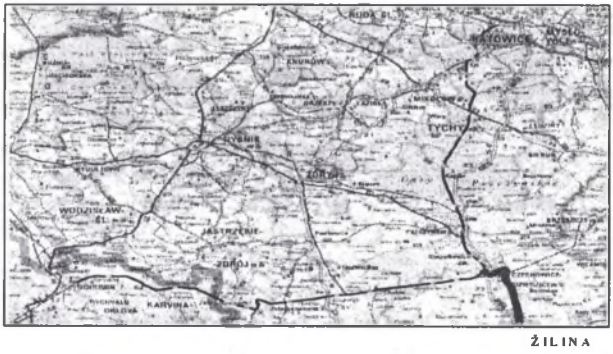

Fig.1. Proposed ERTMS pilot section

This section is a trans-border section connecting Poland with Czech Republic.

2.1. TECHNICAL CHARACTERISTICS OF THE EXISTING CONDITION

Railway line No 139: Katowice – signal-box Most Wisła, two-track and electrified with length 42,200 km has a trunk line parameters and it is adapted to the speed 120 km/h. Railway line No 150: signal-box Most Wisła – Chybie, two-track one, electrified, has trunk line parameters at the section signal-box Most Wisła – signal-box Ochodza with length 2,400 km. Geometry of the route and technical equipment of the section enables travel of passenger and cargo trains with speed 60 km/h .

Railway line No 93: Trzebinia – Zebrzydowice, two-track one, electrified, has trunk line parameters at the section Czechowice Dziedzice – Zebrzydowice – State Border with length 34,000 km enables travel of passenger trains with speed 120 km/h and cargo trains with speed 70 km/h.

Between Katowice and Polish and Czech border there exist 33 interlocking areas here in 23 equipped with mechanical or electromechanical interlocking equipment installed before 1970 and 10 areas with relay equipment of one type installed in nineties of XX century.

The section Katowice – Polish-Czech border is fully equipped with a new tree-point automatic line block based on track circuits. No replacement of train sequence control system is expected as this is new and appropriate equipment.

This section includes 38 protected railway level crossings. A majority of level crossings is equipped with electrical protection systems installed mostly in eighties of XX century. The line features railway level crossings equipped with electronic devices but there are also railway level crossing with mechanical equipment. There also 17 unguarded level crossings at the section Katowice – Polish-Czech border.

Similarly as other lines of Polish railways this section is equipped with an analog radio system operating in the band 160 MHz. This radio is used for voice communication between trackside personnel and train drivers. Based on the same radio equipment also the automatic emergency stopping of trains is realized. For this purpose the onboard radio device is equipped with a RADIOSTOP pushbutton and appropriate bond with the braking system. The RADIOSTOP pushbutton is also available for the trackside personnel.

Similarly as other lines of Polish railways this section is equipped with Polish Automatic Train Braking System – SHP belonging to the AWS class. The SHP system checks the watchfulness of the driver at the distance of 200 meters before the distance signals and inbound (home) signals and the outbound signals. The SHP system is based on electromagnets installed in the track. All locomotives moving along the railway network in Poland have to be equipped with the onboard SHP devices connected with the watchdog (CA).

2.2. TRAFFIC CONSIDERATIONS

The existing train traffic intensity is shown in the Table 1.

Table 1

The existing train traffic intensity at the section Katowice – Bohumin

Section	Express trains	Other passenger trains	Cargo trains
Katowice – Tychy	18	87	54
Tychy – Most Wisła/ Czechowice Dziedzice	16	91	74
Czechowice Dziedzice – Bronów	10	67	109
Bronów – Zebrzydowice – PKP/ČD border	8	46	99
border ČD/PKP– Petrovice	16	4	40
Petrovice– Závada	12	10	45
Závada– Dětmarovice	10	9	39
Dětmarovice– Bohumin	30	57	91

Modernization of the interlocking systems with the insallation of European Train Management System will enable increase of speed and throughput.

It is assumed that at the same time the passenger traffic at the section Katowice - Bohumin will increase at least by 10%. The further increase of passenger traffic will depend of modernization for the speed 200/250 km/h (including installation ERTMS) of CMK line between Katowice and Warsaw.

Increase of cargo train traffic will depend mainly of the cargo traffic development on a wide-track line LHS between Katowice and Eastern states.

Equipping of line will enable formulation of the following statements related with the planned installation ERTMS system at the section Bohumin - Katowice:

- The obsolete mechanical and electromechanical control devices still in use should be replaced by relay and electronic equipment,
- The management of train sequence on the line is realized by new devices of automatic line block. No replacement necessity exists,
- The railway level crossing protection systems are mostly autonomous and are not connected into the signalling system,
- It is planned to divide the section Katowice – Polish-Czech border into five areas of remote control, equipped with the electronic equipment,
- Section Katowice – border PKP/ČD is equipped with an analog radio transmission system operating in the frequency band 160 MHz. The section Bohumin – border ČD/PKP an analog radio transmission system operating in the frequency band 450 MHz. Both systems have to be replaced by GSM-R operating in the frequency band 900 MHz,
- Locomotives travelling on the section Katowice – border PKP/ČD, have to be equipped with national Polish system of class AWS – SHP. Locomotives travelling on the section Bohumin – border ČD/PKP, have to be equipped with national Czech system of class ATP – LS. Both systems operating with the national equipment for controlling the watchfulness of the driver,

- The economical evaluation will have to take into account the expectations for passenger and cargo train. The expected passenger traffic shall take into account the plans concerning CMK line (Katowice - Warszawa) after modernization of this line to the high speeds. Expectations concerning the cargo train have to take into account the forecasts for traffic on LHS line.

The ERTMS system installation will affect the station and line railway traffic control system as well as remote control system. The degree of this impact will depend of ETCS level and applied configuration of trackside equipment serving the purpose of information exchange.

3. EQUIPPING WITH ERTMS

The number of modification of trackside railway traffic control equipment for level 1 ERTMS will depend of the methodology of data collection for the purpose of movement permit issue. It is assumed that the level 1 ERTMS is not suitable for the line in question. It seems that the appropriate level for this section will be Level 2. The Radio Control Center (RBC) is a failsafe centralized unit whose main purpose is to collect data from the existing station and line railway traffic control systems, Their transformation to a format suitable for the radio channel transmission to the cabin, supplementing with the information specific for ETCS, as well as spreading of all necessary information to the trains located in the RBC area in a proper time.

There are two variants of RBC installation for realization of Level 2 in the line section under consideration:

- RBC located in Poland, connected with railway traffic control systems of ČD by CTC,
- RBC located in Ostrava for further development of ERTMS trackside equipment.

A preliminary condition of ERTMS implementation is the existence of remote Traffic Control Centre (CTC). Thus it is assumed that the CTC has to be installed. It would be advantageous to implement also RBC at the same time.

RBC should be installed at the same location that the CTC, so no excess work position are created. Then one operator may handle both RBC and CTC. Depending of local conditions it is assumed that the single RBC covers up to 100 km of double track line, which is approximately equivalent to the efficient CTC solutions.

For the pilot section Bohumin – Katowice the following options are possible:

- CTC located in Ostrava with the RBC located in Poland,
- CTC and RBC located in Poland,
- CTC and RBC located in Ostrava.

A significant problem during implementation of ERTMS is connecting the railway level crossings into the system. There are three basic possibilities of cooperation between the railway level crossing protection devices with the ERTMS/ETCS system:

- First – leaving the railway level crossing protection devices as totally autonomous railway traffic control devices – it is not related with any special requirements concerning the implementation configuration of ERTMS/ETCS, although it gives no improvement in comparison to the present state,

- Second – use of information about the condition of railway level crossing to the modification of static speed profile in the area of level crossing – it is a compromise as it integrates the railway level crossing system with ERTMS/ETCS using the data available at the level of station equipment. In this case the railway level crossing protection devices are not modified in any way,
- Third – control of railway level crossing protection using the information about train location available in the RBC – it is more refined and will probably not be possible without modifying the existing railway level crossing protection systems.

For the purpose of the project the second solution is selected, based upon the use of information about the railway level crossing condition. Where the information about the level crossing condition is transmitted to RBC, it may be used directly to the modification of vehicle speed profile for this level crossing. It is a comfortable solution for taking into account the level crossing protection malfunctions. If the information about the condition of level crossing devices informs that the level crossing (as a standalone device) is OK, then the static speed profile enables travel through the level crossing at full speed (appropriate for the type of level crossing). If the information about level crossing devices does not guarantee correct operation of the level crossing, the speed for this level crossing is modified till 10 km/h for ČD or 20 km/h for PKP, and the driver is informed about the level crossing damage and a necessity to continue the travel with appropriately reduced speed. In addition there may be used a text message transmission with request of confirmation by the driver. In the case of lack of such confirmation from the driver, the train will be stopped before the level crossing. The speed restrictions concerning malfunction of the railway level crossing devices apply only to the train front. In this case, of course, the information about level crossing malfunction is not transmitted either by operator or by the protection of railway level crossing with a main signal. It is also not necessary to use other protection measures, because if the driver tries to exceed the allowable speed the train will be stopped by ETCS system.

SHP System (Automatic Braking System) and Radiostop should be related with ERTMS using STMs (Specific Transmission Modules).

4. THE PROPOSED IMPLEMENTATION SCHEDULE

Strategic Decision of Paneuropean Transport Conferences at Crete in 1994 and in Helsinki in 1997 constitute a basis for implementation of modernization measure program on PKP on selected transport lanes and spilt up into realization tasks. One of them is modernization of section - signal-box Ochodza (signal-box Most Wisła) – Zebrzydowice – Border of the State.

Modernization of the line is planned for two stages:

I stage – so called line rehabilitation (realization period 1995 – 2004)

II stage:

- Adaptation of the line section to the speed 160 km/h (because of track geometry the permanent speed restriction up to 70 km/h will remain at the lane Pruchna – Zebrzydowice),
- Increase of load up to 22,5 ton in accordance with the technical parameters of infrastructure facilities (AGC contract),
- Construction of remote computerized train setting equipment.

Phase I – Construction of remote control

In the second phase it is expected to perform a supervisory layer for control of elements created in phase I. It will enable the pinpoint control as shown in Table 2.

Table 2

The planned equipment of electronic remote control centers at the section Katowice – border PKP/ČD

Item.	Remote control center	Electronic remote control equipment including
1.	**Katowice**	- Interlocking equipment Katowice Osobowa - Interlocking equipment Katowice Towarowa - Interlocking equipment Katowice Zawodzie - Branch signal box Brynów
2.	**Tychy**	- Interlocking equipment Tychy - Branch signal box Mąkołowiec - Interlocking equipment Kobiór - Interlocking equipment Pszczyna
3.	**Czechowice Dziedzice**	- Interlocking equipment Czechowice Dziedzice - Interlocking equipment Czechowice Dziedzice Południowe - Branch signal box Most Wisła - Branch signal box Ochodza - Branch signal box Zabrzeg
4.	**Chybie**	- Interlocking equipment Chybie - Interlocking equipment Pruchna - Branch signal box Bronów - Interlocking equipment Strumień - Branch signal box Bieniowiec
5.	**Zebrzydowice**	- Interlocking equipment Zebrzydowice - Interlocking equipment Kaczyce

Phase II – additional equipping of line section with ERTMS devices.

A possibility exist to add the ERTMS to the line No 139 located in VI transport lane at the section Czechowice Dziedzice – Bielsko Biała – Zwardoń – Czadca – Żylina. At the section Bielsko Biała –Żywiec – Zwardoń a remote control of SIMIS W of Siemens manufacturing is being installed with CTS located in Żywiec. Within this task the I phase of construction was realized i.e. construction of central train setting equipment covering the area of Żywiec, Łodygowice, Węgierska Górka stations. The realization of II stage of the remote setting equipment of ILTIS type by Siemens will take place this year. The Slovak party has installed computer system of EBILOK type on Czadca station, that is a beginning of CTS for the line State Border - Żylina.

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