

POLISH NATIONAL EUROPEAN RAILWAY TRAFFIC MANAGEMENT SYSTEM PLAN

Introduction

PKP Polish Railway Lines S.A. manages about 19 000 km of railway lines in Poland. Railway lines infrastructure comprises about 28 000 km of main tracks and about 9 000 km of station tracks. Railway network in Poland is used by about 5 000 traction vehicles and about 120 000 freight wagons. Passenger transport by rail is served daily by about 3 500 scheduled passenger trains.

Railway network and traction vehicles are equipped with analogue simplex radio devices 150 MHz described in Annex B (Part 2, 10th system) of the TSI CR CCS specification. Traction vehicles are also equipped with AWS type SHP system described in Annex B (Part 1, 19th system) of the TSI CR CCS specification, which is installed on 17 000 km of tracks in Poland.

Signalling devices serve about 50 000 switches and about 50 000 light signals. About 30% of station interlockings are relay ones, about 1% are electronic ones, nearly 70% are old generations ones. The last ones are not suitable for co-operation with ETCS. Due to high variety of solutions in relay interlockings it is practically not feasible to construct unified interfaces for their co-operation with ETCS. Interlockings appropriate for co-operation with ETCS are nearly only present in corridor F, however, even there some stations still have to be equipped with appropriate interlockings. About 16 000 km of lines are equipped with a few types of relay and electronic line block systems. Out of about 15 000 level crossings about 3 000 ones are secured by crossing keepers (category A level crossings), and about 1 800 ones are secured by automatic level crossing protection systems (500 level

crossings of category B secured by barriers and road lights and 1 300 level crossings of category C secured by road lights and not equipped with barriers).

Main barriers in GSM-R and ETCS implementation :

- in GSM-R implementation are of financial nature;
- in ETCS implementation are of technical and financial nature. ETCS system can only be implemented on lines with entirely upgraded signalling. In most cases such upgrading must be preceded by changes in track layout. Therefore ETCS implementation must be done as a final phase in railway line upgrading.

GSM-R and ETCS migration strategy

As a result of many detailed studies following GSM-R and ETCS, the migration strategy has been adopted.

Strategy for railway lines:

GSM-R: Class A train radio-communication system (GSM-R) will be implemented first on part of Corridor F (Legnica – PKP/DB border), then on main lines, then on first-class lines and secondary lines in an appropriate way to enable switching-off of the 150 MHz system, on lines covered by GSM-R implementation, in two steps: first on railway lines in south-west part of the network and then on railway lines in north and in east part of the network. On lines, which are foreseen, in national ERTMS deployment plan, to be equipped with ETCS, system GSM-R will be designed and implemented in a way appropriate to ensure parameters required for using GSM-R as a transmission channel for ETCS level 2.

ETCS: Class A control command system (ETCS) will be implemented first on part of Corridor F (Legnica – PKP/DB border), then on main and first-class lines upgraded as a final phase in railway line upgrading. Railway lines will be equipped with ETCS level 2 devices. Movement authorities will be given via radio using GSM-R system.

SHP: Class B control command system (SHP), working on 17 000 km of tracks, will stay in use minimum up to the year 2025 in particular as it covers many railway lines not foreseen for the implementation of the class A system (ETCS). SHP devices will stay also on railway lines being equipped with ETCS as mixed traffic is foreseen – those lines will be used by trains equipped and trains not equipped with ETCS on-board level 2 devices.

RADIOSTOP: Function RADIOSTOP of the 150 MHz radio, on lines covered by GSM-R implementation, will be used up to the switching off of the radio system 150 MHz on those lines.

Strategy for traction vehicles

GSM-R: Owners and keepers of the traction vehicles (in particular of locomotives as well as of electrical and diesel multiple units) will be obliged to equip those vehicles with on-board GSM-R equipment necessary for voice communication in due time appropriate to maintain radio 150 MHz switch off time in two foreseen steps.

ETCS: Equipping traction vehicles (in particular locomotives as well as of electrical and diesel multiple units) with on-board ETCS equipment and on-board GSM-R equipment necessary for data transmission for ETCS level 2 needs will be done using different financial possibilities, among others:

- within infrastructure projects (for instance within the first implementation on part of Corridor F (Legnica – PKP/DB border) in order to test prototype on-board installations for four types of locomotives EP09, EU07, ET22, SU46 and electrical multiple unit EN57 it is foreseen to equip two locos/EMUs of each type),
- directly from European funds (in particular in case of traction vehicles predestined for trans-border services on ETCS equipped lines),

- from own funds of traction vehicles owners, as well as
- using other financial tools.

SHP: For SHP system an STM module will be worked out, which will fulfil SHP system functions as well as RADIOSTOP function of the 150 MHz radio system. Requirements for SHP STM are ready. This module will be designed, constructed and tested within ETCS implementation on part of Corridor F (Legnica – PKP/DB border). Traction vehicles which will run on lines equipped with SHP and not equipped with ETCS must be able to receive and correctly interpret SHP signals.

RADIOSTOP: Function RADIOSTOP of the 150 MHz radio is covered by STM module for SHP system. Traction vehicles which will run on lines equipped with 150 MHz radio, also in case when the line is already equipped with GSM-R but still equipped with 150 MHz radio, must be able to receive and correctly interpret RADIOSTOP signal.

Decisions to stop maintaining trackside light signals and trackside SHP devices on defined lines, equipped with ETCS level 2, will be taken in relation to number of traction vehicles not equipped with ETCS running on those lines year after year.

GSM-R and ETCS systems implementation plans

Detail data regarding GSM-R and ETCS systems implementation on railway lines are presented on two maps (see Fig. 1. and Fig. 2.).

GSM-R implementation covers:

- - TEN-T network priority lines on Polish territory,
- - ETCS-Net lines pointed in Annex H of the TSI CR CCS;
- - lines upgraded with the use of the European funds, and
- - other railway lines, on which GSM-R implementation is necessary to obtain benefits arising from network implementation of this system.

ETCS implementation covers:

- - TEN-T network priority lines on Polish territory,

- - ETCS-Net lines pointed in Annex H of the TSI CR CCS (Fig. 2), and
- lines upgraded with the use of the European funds.

GSM-R implementation plans for railway lines

The Telekomunikacja Kolejowa Company is responsible for supervising GSM-R implementation on railway lines in Poland and for operating and maintaining GSM-R instalations, which have been put into service.

GSM-R implementation plans are shown on a map (see Fig. 1) The plans are at the map on which implementations in following years are marked with different colours.

The tender for the first common GSM-R and ETCS implementation will be organised in the first quarter of the year 2007. Common

GSM-R and ETCS construction will take place at the turn of 2007 and 2008. Eighteen weeks are foreseen for functional GSM-R tests, including the verification of Polish implementation requirements for that system.

ETCS implementation plans for railway lines

The PKP Polskie Linie Kolejowe Company is responsible for supervising ETCS implementation on railway lines in Poland and for operating and maintaining ETCS instalations, which have been put into service.

ETCS implementation plans are shown on a map (see Fig. 1.). Plans are at a map, on which implementations in following years are marked with different colours.

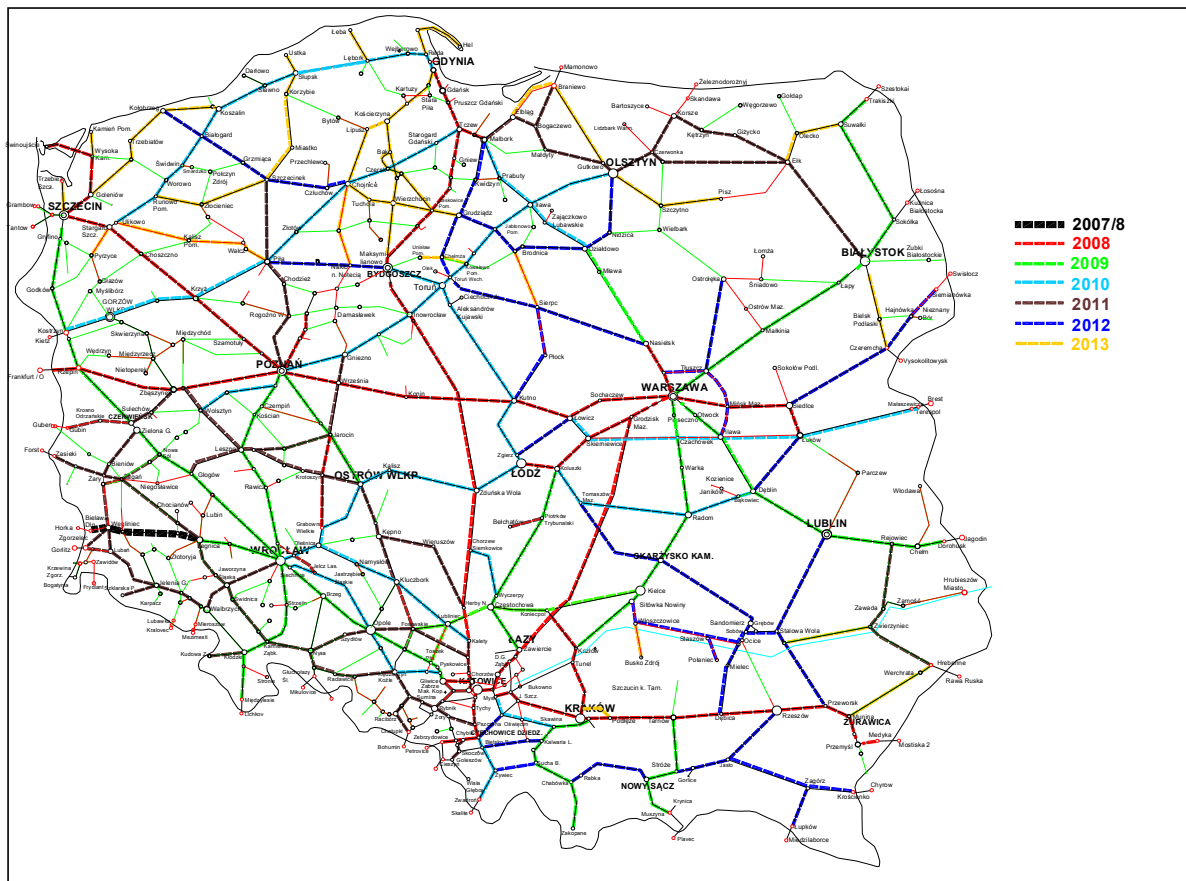


Fig. 1. GSM-R implementation plan year after year

The tender for the first common GSM-R and ETCS implementation will be organised in the first quarter of the year 2007. Common GSM-R and ETCS construction will take place at the turn of 2007 and 2008. It is expected,

that functional ETCS tests, including verification of Polish implementation requirements for that system, can take up to eighteen months.

Plans regarding equipping traction vehicles with GSM-R and ETCS

It is expected to equip traction vehicles with on-board ETCS equipment and GSM-R equipment necessary for ensuring data transmission for ETCS level 2. On lines equipped with ETCS mixed traffic is foreseen (vehicles equipped and not equipped with ETCS). The scale of vehicles equipping will depend on many factors and decisions in that respect will

have to be undertaken by separate railway undertakings.

The first ERTMS implementation project on part of Corridor F (Legnica – PKP/DB border), in order to provide support for vehicles equipping, foresees equipping with GSM-R and ETCS five types of traction vehicles (EP09, EU07, ET22, SU46 and EN57, two vehicles of each type) and conduction of appropriate tests.

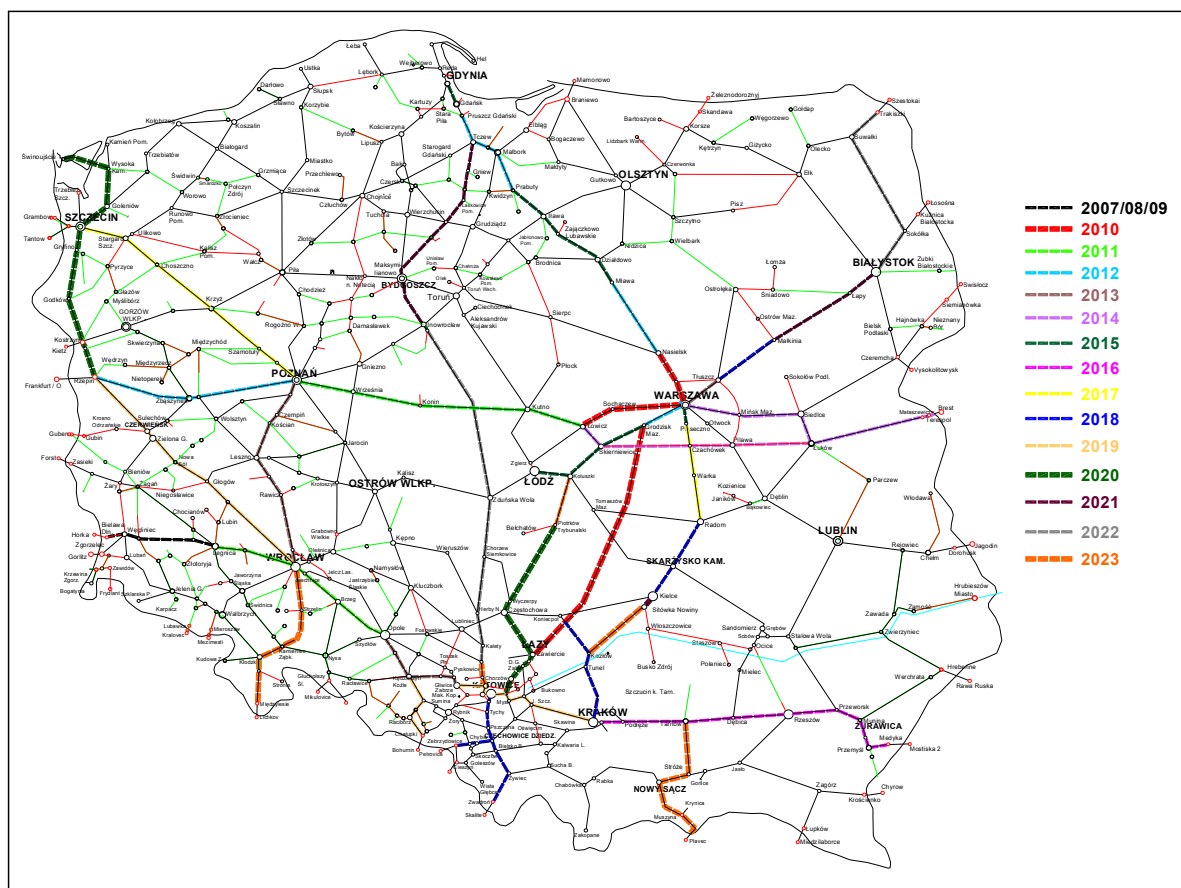


Fig. 2. ETCS implementation plan year after year

In order to support vehicles equipping it is also foreseen to consider further financing of equipping traction vehicles with ETCS within infrastructure projects as well as to differentiate access rates to lines equipped with ETCS level 2 for trains equipped and not equipped with ETCS level 2 equipment.

Not all existing traction vehicles could be and shall be equipped with on-board ETCS equipment. Some are too old. Those vehicles will be replaced by new ones and therefore it is important to adopt rules regarding ETCS in new traction vehicles.

New traction vehicles, for which negotiations and contracts are conducted and realised after approval of the “Polish National European Railway Traffic Management System Deployment Plan” would be ordered already equipped with ETCS level 2. The deviation from this rule is possible when a certain vehicle (e.g. rail-bus for local transport) is foreseen, in principle, to run on railway lines, which are not foreseen to be equipped with ETCS in the “Polish National ERTMS Deployment Plan”.

Additional requirements

For the implementation of GSM-R and ETCS it is necessary to define some requirements on a national level. Following requirements on one side ensure using the same solutions in different contracts in Poland, and on the other side ensure preserving European interoperability of the Polish GSM-R and ETCS implementations, as defined in this chapter Polish GSM-R and ETCS implementation conditions do not go beyond functionalities defined in the European specifications of those systems.

Polish requirements for GSM-R implementation

For each railway line equipped with GSM-R as long as it is still equipped with 150 MHz radio system trackside devices must ensure, that:

- - when signal RADIOSTOP is generated by trackside equipment it is accompanied by automatically generated GSM-R alarm signal,
- - when signal RADIOSTOP is received by trackside equipment (e.g. signal generated by the driver) GSM-R alarm signal will be automatically generated,
- - when GSM-R alarm signal is generated by trackside equipment it is accompanied by automatically generated RADIOSTOP signal, and that
- - when GSM-R alarm signal is received by trackside equipment (e.g. signal generated by the driver or generated by worker moving along the tracks) a RADIOSTOP signal will be automatically generated.

An SHP STM module (covering receiving and proper interpretation of RADIOSTOP signal) has to ensure the proper interpretation of the RADIOSTOP signal by traction vehicles equipped with ETCS and SHP STM when they are running on lines equipped with SHP and 150 MHz radio and not equipped with GSM-R.

GSM-R dispatcher terminals, cab radios, and mobile terminals have to communicate with users in the Polish language. Used words and expressions will be agreed with the infrastructure manager during the first implementa-

tion on part of Corridor F (Legnica – PKP/DB border).

The possibility to transfer areas of responsibility (roles) between dispatchers must be ensured. Roles definitions and definition of possible configurations of their assignment to dispatchers will be defined by infrastructure manager. The role transfer has to be organised in the way which ensures that one and only one dispatcher is responsible for each area (role) at any moment.

Polish requirements for ETCS implementation

The level crossings of category A, B and C, equipped with autonomous protection systems (securing of the level crossing is not required to give movement authority) must be directly linked with ETCS. The information about approaching not-closed level crossing will be transferred in the ETCS language by temporary speed restriction to 20 km/h and a text message. Level crossing protection devices, for this purpose, could be linked with balises e.g. by connecting balise group (minimum two balises) to a level crossing distant signal or could be linked with Radio Block Centre. Temporary speed restriction could be cancelled if level crossing becomes closed.

ETCS system uses single balise groups and balise groups containing minimum two balises. Balise groups and single balise groups will be used depending on location. A group of minimum two balises must be used on entrance to the equipped line and exit from the equipped line. Such a group must be put also in the middle of the block section on an open line. Groupe of minimum two balises could be also connected to a level crossing distant signal. Single balise groups must be put on switches (at point of switch tongue and at fouling point on both tracks), by entrance signals, by exit signals, by station intermediate signals and by shunting limit signal.

NID_BG balise group number is assigned to each balise group, even single balise group. NID_BG numbers are assigned by the infrastructure manager.

Introducing temporary speed restrictions into ETCS system must be possible from RBC operator level as well as by installation on

track two movable balises. Such balises must be available in pairs as they are not linked with other balise groups by linking distances.

Driver interface (DMI) and RBC operator interface of the ETCS system have to communicate with users in the Polish language. Used words and expressions will be agreed with the infrastructure manager during the first implementation on part of Corridor F (Legnica – PKP/DB border). Expressions for the text messages pointed by variable Q_TEXT will also be agreed.

Preliminarily agreed values of the national variables could be changed after tests on part of corridor F (Legnica – PKP/DB border) foreseen within the first ERTMS implementation in Poland.

PKP signal aspects coding in ETCS language should be based on defining speed profiles based on data about block section occupancy as well as on operational data from station signals. At the same time data about the state of the station signals have to be taken directly from devices co-operating with certain signal (e.g. from light circuits of a certain signal), and not from aspect of the previous signal.

Interfaces between ETCS and signalling devices (which ensure source data for movement authorities) must fulfil SIL4 safety requirements.

References

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Key words: management system, railway network, vehicles, implementation plans

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