

ERTMS, TSIs, ETCS, GSM-R

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TECHNICAL SPECIFICATIONS FOR THE INTEROPERABILITY OF THE TRANS-EUROPEAN CONVENTIONAL RAIL SYSTEM

Paper presents European interoperability related matters namely ERTMS related projects (E-20 & E-65 visibility studies, cross-border pre-study PKP/ČD, implementation strategy) as well as technical standards for upgrading Warsaw-Katowice line to 200/250 km/h, and technical standards for upgrading Polish international railway lines. It presents co-operation between PKP Group representatives in the European Association for Railway Interoperability (AEIF) and supporting experts from different PKP Group companies.

TECHNICZNE SPECYFIKACJE DLA INTEROPERACYJNOŚCI TRANSEUROPEJSKIEGO SYSTEMU KOLEI KONWENCJONALNYCH

Artykuł prezentuje prowadzone w Polsce prace związane z europejską interoperacyjnością kolei. W szczególności krótko omówiono projekty związane z wdrożeniem Europejskiego Systemu Zarządzania Ruchem Kolejowym ERTMS: studia wykonalności dla linii E-20 i E-65, wstępne studium transgranicznej eksploatacji na granicy PKP/ČD, prace nad strategią wdrożenia. Krótko przedstawiono także standardy techniczne dla modernizacji linii Warszawa-Katowice do prędkości 200/250 km/h oraz standardy techniczne dla modernizacji polskich międzynarodowych linii kolejowych. Przedstawiono także współpracę między reprezentantami Grupy PKP w pracach Europejskiego Stowarzyszenia dla Interoperacyjności Kolei (AEIF) i ekspertami wspomagającymi z różnych spółek Grupy PKP.

1. INTRODUCTION

We already know that Poland will join European Union on the first May 2004. Taking this into account Polish State Railways (PKP) have to answer a question "what does it mean for railway transport in Poland". In order to answer such question it is necessary to summarise the actual state of the art of railway transport in European Union and in Poland first from the legal and then from the organisational and technical point of view.

For those purposes PKP have two dedicated teams - Integration Team and Interoperability Team. The work of Integration Team covers all legal aspects of all EU legal regulations (Directives, Decisions, and Recommendations) dedicated for railway transport. The work of Interoperability Team is dedicated to Directives 96/48/EC and 2001/16/EC and supplementing

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legal documents (e.g. Decisions 2001/260/EC, 2002/730/EC ÷ 2002/735/EC; Recommendation 2001/290/EC) and therefore focusing on organisational and technical questions. This paper summarises the work of Interoperability Team.

The interoperability organisational and technical regulations will considerably affect railway transport in Poland. They are in principle seen as a challenge, but at the same time they have to be seen as threats. Interoperability regulations will force best organisational and technical solutions giving railway transport in Poland an opportunity to become modern and serve better national and European economy. The risk is that interoperability regulations will force technical solutions, which will fit to existing railway infrastructure in EU countries but will not fit existing railway infrastructure in Poland.

The Directive 96/48/EC was issued in 1996. It is supplemented with Decisions 2002/730/EC ÷ 2002/735/EC containing Technical Specifications for Interoperability dedicated to all six sub-systems defined in the directive. Polish experts were practically not involved in preparation of those decisions, but they are not affecting railway transport in Poland so much as PKP have no high speed lines at the moment (see chapter 2.).

It is extremely lucky that Polish experts are involved in preparation of Technical Specifications for Interoperability (TSIs) supplementing Directive 2001/16/EC. Those TSIs will be issued as European Commission Decisions and will be applicable in Poland and therefore it is extremely important for us that they fit existing railway infrastructure in Poland (see chapter 3).

2. POLISH PROJECTS RELATED TO THE EUROPEAN RAILWAY INTEROPERABILITY (DIRECTIVE 96/48/EC)

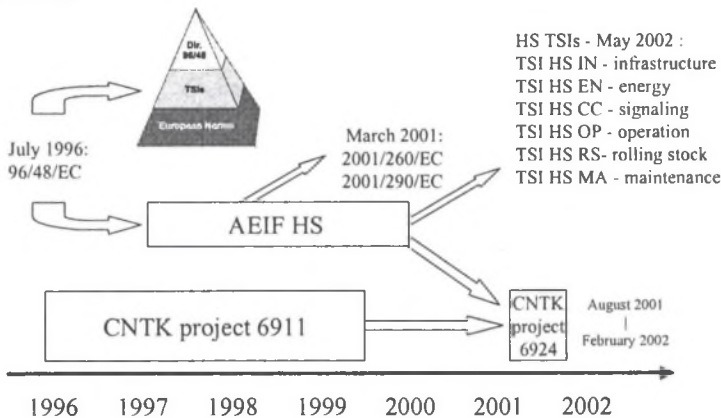
PKP intends to upgrade Warsaw - Katowice line for 200/250 km/h (the speed will depend on traction power supply possibilities). The detail requirements for upgrading are based on earlier Polish works and drafts of high speed TSIs.

Requirements for upgrading to 200/250 km/h of the Warsaw - Katowice line are covering:

- permanent way,
- bridges and civil engineering,
- control command and signalling,
- traction power supply,
- power supply for other purposes (signalling ...),
- overhead line construction,
- mobile radio-communication,
- locomotives (for up to 200 km/h),
- wagons (for up to 200 km/h),
- trains (for up to 250 km/h),
- train operation,
- environmental protection.

The high speed TSI for Control Command and Signalling sub-system requires use of European Train Control System (ETCS) and Global System for Mobile Communication - Rail

(GSM-R) together forming European Railway Traffic Management System (ERTMS). It is known since quite a long time that use of ETCS and GSM-R will also be required for conventional lines.



Following CNTK feasibility projects were based on GSM-R standard:

- 1995 "mobile radio-communication for passengers",
- 1996 "technical & economical analyses of proposed beam network implementation in Poland",
- 1996 "mobile radio-communication for lines with centralised train dispatch - system proposal",
- 1998 "recommended radio-communication system study",
- 2001 "requirements for the GSM-R applications".

The first ETCS implementation study titled **"ERTMS pilot installation on the Kunowice - Warsaw E-20 line"** was conducted in two phases as a Phare project between 1996 and 1998. During first phase all possible ETCS configurations were analysed from technical, operational, and economical point of view to choose two configurations for detail analyses in phase 2. (ETCS level 3 configuration was not taken into account.) In phase 2 detail analyses were conducted for level 1 based on eurobalise spot transmission supplemented by euroloop infill and for level 2 based on euroradio data transmission channel. It was proposed to implement ETCS level 2 at the E-20 line connecting Warsaw and Berlin.

In 1999 **"ERTMS Strategic Study for Central and East European Countries"** was conducted in two phases. During phase 1 project was entitled to nominate Central and East European railway lines to be equipped with ETCS. Following lines were chosen:

- Decin-Praha-Bratislava-Hegyeshalom (corridor IV),
- Bratislava-Sturovo-Szob-Budapest (corridor IV),
- Sezana/Koper-Ljubljana-Győr (corridor V),
- Warsaw-Katowice-Breclav (corridor VI).

During phase 2 project has covered economical and financial analyses for all three ETCS levels. For the Warsaw-Katowice-Breclav project proposed ETCS level 1 stating that ETCS level 2 configuration have to be analysed in details once again when more economical information will be available.

In 2002, within UIC ETCS project, representatives of ČD, PKP, and UIC prepared **“ERTMS cross-border operation pre-study for section Katowice – Bohumin of the VI European corridor”**. Project was covering:

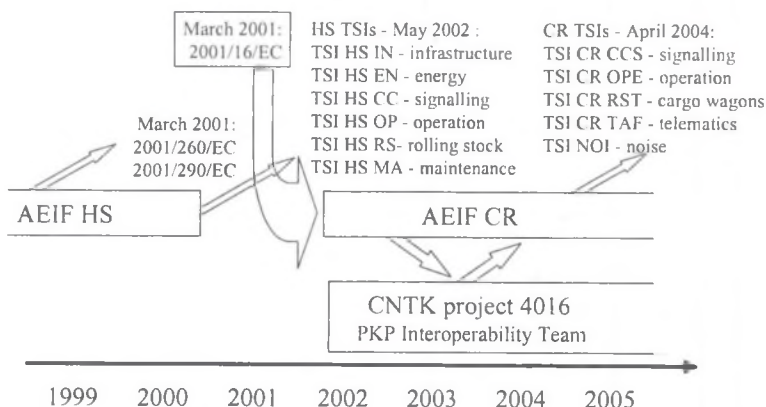
- collection of relevant data,
- indication of the ERTMS/ETCS functionality required,
- comparison between the operational situation today and with ERTMS/ETCS,
- investigation of technical aspects of the different application configurations.

As an outcome of the project PKP and ČD have: advantages and disadvantages of the different application configurations, as well as recommendations based on functional and technical analysis. This project was not covering economical and financial analyses.

ERTMS national implementation requirements project:

Choosing lines and configurations is only part of the work, which has to be done before ERTMS implementation in Poland. An ERTMS dedicated pre-implementation study aiming at detail definition of national requirements was started at the end of the year 2002. This study will answer following questions:

- Which ETCS FRS 4.29 functions have to be available?
- What are the values of national variables for PKP?
- How to translate PKP signalling into ERTMS language?
- How the vigilance equipment will be integrated with on-board ETCS kernel?
- How to start running when the train does not know its position in a safe way?
- How to pass failed signals?
- What kind of MMI should be used?
- What is required to be done by RBC (RBC functions)?
- How to collect data for RBC databases?
- How to take information from existing block systems and interlockings?
- How to organise train transitions between unfitted lines and RBC areas?
- How to connect level crossings with ERTMS equipment?
- How to introduce GSM-R?
- How to correlate the GSM-R radio network elements (needed for single lines and for whole network)?



For this work in order to satisfy needs and requirements of different companies within PKP Group railway headquarters decided to establish a separate team (ERTMS pre-implementation Team). This team, consisting of specialists nominated by different PKP Group companies (similarly to both teams mentioned at the beginning), has also to define: pilot implementations, configurations for different lines, and sequence of ETCS and GSM-R implementation on Polish railway lines to be included in Trans European Network.

3. POLISH INVOLVEMENT IN AEIF WORKS ON THE TSI SPECIFICATIONS (DIRECTIVE 2001/16/EC)

High speed Technical Specifications for Interoperability have been prepared practically without Polish involvement, although they are based, to some extent, on earlier UIC leaflets and projects. ETCS and GSM-R projects involving PKP experts can be pointed as examples. Conventional Railway Technical Specifications for Interoperability (CR TSIs) will be applicable, according to existing legal documents, on 5 277 km of Polish railway lines which will be included in Trans European Network before the year 2010 or, according to proposed legal documents, on all Polish (as well as on all European) railway lines.

As it was already written in the introduction, interoperability regulations are seen first of all as a challenge, but at the same time they have to be seen as threats.

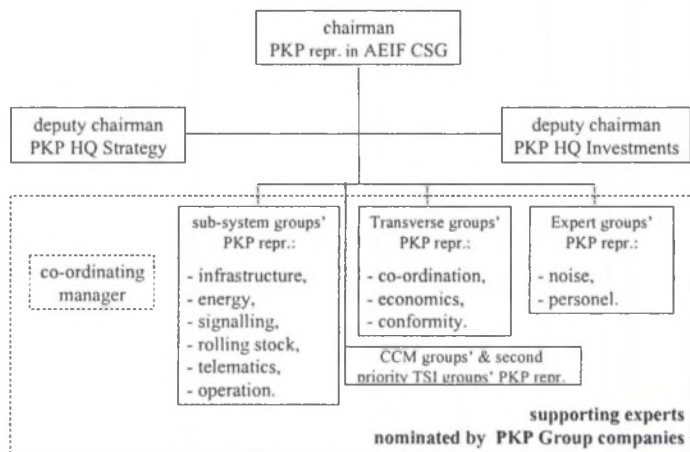
In order to protect railways against extremely costly solutions Directive 2001/16/EC provides legal possibility to define so called “specific cases”. During works on TSIs relevant AEIF groups define first of all future unified solutions, which are then put in chapters 4 of relevant TSIs. At the same time national experts have to compare proposed future unified solutions with those actually in use in order to define proposed specific cases, which are then put in chapters 7 of relevant TSIs.

On one side in order to achieve reasonable interoperability TSI specifications should include as little specific cases as possible. On the other side in order to protect railways against costly solutions certain specific cases are required. Any railway can ask for as many specific cases as it wants, but relevant AEIF group working on TSI specification has to accept draft TSI specification including mentioned chapter 7 before it will be forwarded to European Commission. In case of doubtful proposals when relevant group is not able to reach consensus AEIF can discuss it on the level of co-ordination system group and make economical evaluation by AEIF EE group.

A railway, which is not involved in AEIF works on TSI specifications for trans-European conventional rail system, is not able to define appropriate specific cases during works on draft TSIs. Taking this into account Polish State Railways decided to send representatives to all AEIF groups relevant for conventional TSIs.

The interoperability directive for conventional rail system was issued in March 2001. In June EU countries decided that AEIF will act as a “joint representative body” for the preparation of relevant TSI specifications. First AEIF CR groups started in October 2001. In some groups PKP representatives were involved from the beginning. In March 2002 PKP was represented in all relevant AEIF groups and PKP Headquarters decided to establish PKP Interoperability Team.

As it was already mentioned PKP Group is subdivided into separate companies, having in some cases different needs. Therefore an appropriate way for exchange of information was strictly necessary. On one side PKP representatives in AEIF have to inform PKP Group's companies about state of works, proposed destination solutions, specific cases requested by other countries. On the other close co-operation with local experts representing separate companies is necessary for defining Polish specific cases. As a result 18 PKP representatives in AEIF are supported by over 100 supporting experts nominated by PKP Group's companies.



Each PKP representative meets with relevant supporting experts. Between March 2002 and June 2003 there were more than 60 such meetings. PKP group representatives met 6 times to exchange information. From each meeting CNTK is preparing the minutes. Each quarter of the year Interoperability Team is passing to PKP Group companies' management boards' members "Quarter Report on AEIF works on TSIs for conventional rail system". Interoperability Team issued also "Opening Report" and a "Year Summary". The scale of work and amount of documents are such that it is hardly possible for management boards' members to follow. In order to allow management boards to focus on relevant most important questions it was agreed that Interoperability Team will have a possibility to issue so called "Derogation/No Derogation Information Sheets". Up to now nine such sheets were issued and answered by management boards. Those sheets are used to find consensus in difficult questions before PKP position can be presented on AEIF level. Within "Derogation/No Derogation Information Sheets" Interoperability Team defines not only the question and possible answers and their consequences but also concerned PKP Group companies and deadline for answer. An answer received after deadline may be omitted as relevant AEIF discussion may be already closed.



4. PROJECTS RELATED TO THE EUROPEAN RAILWAY INTEROPERABILITY (DIRECTIVE 2001/16/EC)

CNTK is elaborating at the moment **“Requirements for upgrading conventional international railway lines”**. This requirements are already now based on working AEIF documents as they contain information about future European standards which will be applicable on Polish railway lines.

Already now within implementation projects PKP PLK has to prove that all the works are compliant with relevant EU legal regulations. This is important on one side to be able to achieve European financial support, but on the other side it is important from the point of view of using line capacity by different railway undertakings especially on the lines to be included in Trans European Network.

5. CONCLUSIONS

In the past PKP and CNTK were involved in ERRI, UIC, CEN, CENELEC and OSZhD works on solutions, standards and leaflets. Since 2001 we are involved in AEIF works on Technical Specifications for Interoperability supplementing Directive 2001/16/EC. For the first priority TSIs we already analysed proposed destination solutions and defined required specific cases for instance related to track gauge change on PKP east border 1435/1520.

After issue of the TSIs all lines will have to be reflected in “infrastructure register” while all vehicles will be reflected in “rolling stock register”. Competitive railway undertakings will operate trains on railway infrastructure managed by separate companies. The registers are not yet defined but their future content is already imaginable.