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The 'High-Speed Railway Development in Poland' Conference – What comes next?

Abstract: On 28-30 October 2024 in Łódź, during International Scientific and Technical Conference 'High-Speed Railway Development in Poland', the needs, opportunities, and challenges related to the ongoing preparation, subsequent implementation, and future operation of high-speed rail in Poland were widely discussed. Statements made during debates and discussions accompanying various presentations were used to formulate conclusions, which were documented and handed over to decision-makers and stakeholders for their use. This article presents and briefly summarises those conclusions, making them accessible to all interested parties.

Keywords: High-speed rail (HSR); Compatibility of HSR with the Polish railway system; Building HSR competence

Introduction

On 28 October 2024, four debates took place, focusing on the following topics: 1. 'High-Speed Rail for Poland,' with an opening address delivered by Minister Piotr Malepszak; 2. 'PKP PLK and CPK investments are an opportunity for the development of Łódź and Central Poland,' with an opening address from the CPK company authorities; 3. 'The role of high-speed rail as an element of the TEN-T network in the development of an integrated European railway system,' with an opening address from the PKP PLK company authorities; and 4. 'Complementary Services for the High-Speed Rail system,' with an opening address from the PKP company authorities. Over the following two days, nearly fifty presentations were delivered across seven sessions, offering perspectives from both railway entities and industry stakeholders on topics including: engineering structures, track infrastructure, control systems, safe train operation monitoring, communication, traction power supply, high-speed rail rolling stock and complementary services, as well as legal and organisational challenges. Following the conference, six key conclusions were formulated, documented, and handed over to decision-makers and stakeholders for further use. These conclusions are quoted and briefly discussed below.

Conclusions from the Conference

A broad and comprehensive discussion on the needs, opportunities, and challenges related to the development of high-speed rail (HSR) in Poland highlighted numerous issues requiring particular attention and pointed to necessary complementary actions. Each of the conclusions below is presented as a separate subsection.

Complementary infrastructure projects for HSR

The following conclusion was formulated in this area:
The construction of an HSR line through Łódź, which will carry high passenger volumes, creates an urgent need to launch infrastructure projects on complementary railway networks to accommodate the increased capacity demands for both conventional long-distance and regional rail services in central Poland. These projects should include: (1) Increasing the

permitted speed and installing automatic line block signalling on the Łódź – Sieradz section; (2) Upgrading the Zgierz – Kutno line to a double-track railway with a speed limit of up to 160 km/h; (3) Modernising the Łódź Widzew – Tomaszów Mazowiecki – CMK connection for speeds of up to 200 km/h.

Ensuring technical compatibility between HSR solutions and the characteristics of Poland's existing railway network—allowing HSR rolling stock to operate on other currently used railway lines—is the bare minimum. However, experiences from other countries and a holistic view of the railway system indicate that such a minimum is often insufficient for fully leveraging the potential of high-speed rail. Therefore, in parallel with the construction and commissioning of HSR lines, investments in conventional infrastructure should be carried out—eliminating bottlenecks that may not yet be critical but will become obstacles to fully utilising the HSR network's potential in the future. Without identifying and implementing these conventional infrastructure investments, the reduction in travel times will not be accompanied by the necessary increase in capacity and operational flexibility. This, in turn, will become a barrier to meeting the rising demand for rail transport, which will grow as service quality improves and travel times decrease.

HSR rolling stock and complementary transport vehicles

The following conclusion was formulated in this area:

The commencement of HSR line construction creates an urgent need to define both the organisational model and funding principles for rolling stock. It is essential to swiftly determine a comprehensive set of requirements for both high-speed rolling stock and vehicles necessary for complementary transport services. Given the long lead times required for contracting, manufacturing, and delivery, and considering that the rolling stock will undoubtedly be produced to precise, pre-defined specifications, appropriate decisions and actions must be taken without delay.

A holistic approach to transport services utilising high-speed rail lines must not overlook the availability of rolling stock suited to different types of services. Not all trains operating on HSR lines need to utilise the maximum permitted speed in full. This means that now is the time to plan the transport service offer and define the number and specifications of trains required to meet the planned service demand, as new trains are not available off-the-shelf but are produced to order. Considering the time required for tender documentation preparation, procurement procedures in accordance with public procurement law, manufacturing, certification, and final approvals, the target organisational model must be defined immediately. Securing funding and initiating prompt action is critical to ensuring that the necessary rolling stock is available when the infrastructure investment is completed.

Defining and implementing principles for developing HSR competencies in the national industry

The following conclusion was formulated in this area:

The goal of maximising the potential of Polish companies in the construction and operation of high-speed rail (HSR) lines creates an urgent need to define and implement principles that will enable the domestic industry to develop rationally justified solutions for HSR. These principles should ensure that design competencies are expanded and production resources are developed within Poland. This is necessary not only to keep tax revenues and highly skilled jobs within the country but also to facilitate a future technological leap for conventional railway lines and to enable Polish companies to compete internationally, for example, in the construction of a Warsaw – Kyiv railway connection.

Both HSR infrastructure investment and the production of appropriate rolling stock require the advancement of competencies within the local industry, ensuring that at least part of the funding continues to benefit the Polish economy for as long as possible.

The Polish railway system is one of the largest in Europe. It is worth recalling that in 2004, when Poland joined the European Union, its railway network accounted for 50% of the new railway infrastructure added to the EU—meaning that the remaining nine new member states combined had a network roughly equal to Poland's. The scale and volume of railway infrastructure investments in Poland have increased since then, and many local construction contractors carry out these projects. Although railway investment in recent years has been focused almost exclusively on modernising existing lines, Polish contractors have acquired a number of high-performance railway construction machines. Additionally, many of the materials and components used in these projects are produced domestically. However, this does not mean that railway construction contractors and railway infrastructure manufacturers do not need to expand and refine their competencies—they do, and significantly so, because HSR is a completely different level of technology and project complexity. The competition will be at least European-wide, but excluding local businesses from such a major investment at the outset is not an option.

Similarly, in rolling stock production, Poland has several train manufacturers due to the scale of its railway transport sector. The increase in train speeds requires substantial changes in technical solutions, making it necessary to develop new competencies and enhance existing technologies. As in infrastructure, the rolling stock procurement process will attract multiple foreign bidders, but it is critical to ensure that Polish companies are not excluded from the outset.

History has shown that large railway infrastructure projects can transform not only transport networks but also the local economic landscape. The same should happen in this case. However, achieving this requires effective communication between industry and decision-makers regarding expected technical characteristics, development trends (e.g. standardisation of interfaces in control systems), and cybersecurity requirements.

Development of domestic polish solutions for the 2 x 25 kV AC power supply system

The following conclusion was formulated in this area:

One of the challenges will be the development of a domestic 2 x 25 kV AC power supply system. Such a system can be purchased based on European requirements, but Poland has the resources to create national solutions. This requires urgent decisions, including the establishment and launch of a research and development programme, as well as consideration and possible initiation of the procurement of, among other things, dedicated transformers adapted to Poland's national power system.

A particularly significant challenge will be the transition to a new traction power supply system. Currently, no railway lines in Poland use AC power supply, yet this will be essential for high-speed rail. With the existing 3 kV DC system, it is impossible to achieve sufficiently high train speeds. The challenge will not only involve the railway-specific aspects of power supply but also its integration with the national power grid and the expansion of energy generation capacity to ensure adequate power availability. Additionally, interface points between tracks with different traction power systems will pose a further technical challenge.

Unification of technical standards for HSR lines

The following conclusion was formulated in this area:

The commencement of work on tender documents for the construction of the first HSR sections between Warsaw and Łódź, as well as the decision that CPK will transfer completed

HSR lines to PKP PLK for operation, highlights an urgent need to establish unified technical standards.

PKP PLK currently applies standards developed in 2009, which have undergone only minor updates in subsequent years and do not reflect the latest requirements of the Technical Specifications for Interoperability (TSI). In contrast, CPK uses standards developed in 2021, which underwent substantial refinements in 2022 and 2023. While CPK's standards cover a significantly broader scope of requirements, they must be updated following changes to nine TSI specifications (Regulation (EU) 1694/2023) and require extensive revisions to safe train control requirements based on the new edition of the TSI specifications for control-command and signalling (Regulation (EU) 1695/2023).

A common set of railway standards should also incorporate detailed, unified requirements for infrastructure design using BIM (Building Information Modelling) technology. BIM facilitates rapid and efficient decision-making during the operational phase after the lines are commissioned. Given the numerous infrastructure interface points, the General Directorate for National Roads and Motorways (GDDKiA) should also adopt BIM standards for road infrastructure design.

During the conference, selected volumes from the 32-volume set of Polish railway standards developed for CPK were presented. Additionally, arguments were made regarding the need to supplement these standards, for example, in the area of digital documentation using BIM. Updates are also necessary in ETCS (European Train Control System) standards following the introduction of ETCS Baseline 4 in European regulations. Furthermore, existing standards do not yet account for the new railway communications system, FRMCS (Future Railway Mobile Communication System). It is also essential to ensure compatibility between the standards used by PKP Polskie Linie Kolejowe S.A., which manages the main national railway network, and those developed for CPK, which apply to high-speed railway line design.

Development of research and testing facilities

The following conclusion was formulated in this area:

It is essential to urgently adopt a plan and proceed with the construction and commissioning of appropriate testing facilities, including: (1) A temporary test site within the first section of the Warsaw–Łódź HSR line, dedicated to testing and certifying railway infrastructure and rolling stock for the launch of initial services on the high-speed line; (2) A permanent, independent testing facility, separate from the HSR network, which could continue to be used after the commencement of high-speed rail operations for the development and validation of various HSR technologies, both current and future. This includes rolling stock, from trainsets to special-purpose vehicles (e.g. diagnostic trains), high-speed rail turnouts, digital systems, ranging from traditional control systems and safe train operation monitoring to automated ATO/ATS systems and cybersecurity protections.

Before HSR infrastructure and rolling stock can be commissioned for operation, they must undergo formal acceptance based on prior testing. However, this is only a temporary research challenge. A much greater challenge lies in establishing a long-term testing facility for refining and approving local technical solutions, both during HSR construction and after its launch. Poland already possesses some relevant infrastructure and expertise, such as the test track near Wrocław, but these are insufficient for high-speed rail. A particular challenge in this area will be the use of AC power supply, though this is only one example. Many new or modified solutions for high-speed infrastructure and rolling stock cannot be safely tested in commercial operations, yet technological advancements will undoubtedly require such testing. Without a dedicated research and testing facility in Poland, the implementation of technological progress will continuously depend on foreign solutions, thereby missing the

opportunity for synergies between this major infrastructure project and domestic economic development.

Conclusion

The conclusions from the conference ended with the assertion that:

It is essential to urgently adopt a plan and proceed with the construction and commissioning of appropriate testing facilities, including: (1) A temporary test site within the first section of the Warsaw–Łódź HSR line, dedicated to testing and certifying railway infrastructure and rolling stock for the launch of initial services on the high-speed line; (2) A permanent, independent testing facility, separate from the HSR network, which could continue to be used after the commencement of high-speed rail operations for the development and validation of various HSR technologies, both current and future. This includes rolling stock, from trainsets to special-purpose vehicles (e.g. diagnostic trains), high-speed rail turnouts, digital systems, ranging from traditional control systems and safe train operation monitoring to automated ATO/ATS systems and cybersecurity protections.

There is no doubt that the construction and launch of high-speed rail in Poland should transform railway transport, not only along the HSR corridor itself but also on a much broader, network-wide scale, as well as the economy in the wider construction sector, including the production of building materials, the execution of linear and infrastructure construction works, the manufacturing of equipment, and the performance of installation, repair, and maintenance activities. It should also impact the rolling stock sector in the broadest sense, covering HSR trains, rolling stock for complementary transport services, maintenance and repair work, and rolling stock depots. To make this possible, the conclusions from the HSR Conference in Łódź, as outlined above, should already be taken into account in the planning and implementation of Poland's high-speed rail project.