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THE IDENTIFICATION OF HAZARDS CONCERNING THE CHARACTER OF CONSTRUCTION WORKS ON RAILWAY SITES IN POLAND

IDENTYFIKACJA ZAGROZEŃ WYNIKAJĄCYCH ZE SPECYFIKI ROBÓT BUDOWLANYCH NA OBIEKTACH KOLEJOWYCH W POLSCE

Abstract

The railway investment in Poland is subject to many random factors, which have a significant impact on extending the deadline and increasing the planned cost. Railway investments are characterized by their distinctiveness in comparison to other construction works. To minimize the occurrence of unforeseen, random risks in future rail investments, the authors attempted to identify and indicate the most likely of them. The analysis concerns the implementation of railway investments in Poland, taking into account its legal and technical characteristics. The basic method of identifying the hazards of railway investments in Poland was a case study. The main threats were: bad preparation of the main contractor, difficulties in obtaining maps for design purposes, delay in the design documentation with external stakeholders, the award of contractor closures, difficulties in carrying out works related to encountering undeclared underground infrastructure and other hidden obstacles as well as the influence of the contracting party's internal procedures on the course of the contract.

Keywords: threat identification, risk, railway investments, planning of construction works

Streszczenie

Przebieg inwestycji kolejowych na terenach Polski jest obciążony wieloma czynnikami losowymi, które mają istotny wpływ na wydłużanie terminu ich zakończenia oraz wzrost planowanego kosztu. Inwestycje kolejowe charakteryzują się specyfiką wyróżniającą je na tle innych robót budowlanych. Autorzy podjęli próbę ich rozpoznania. Podstawową metodą przeprowadzonych badań było studium przypadku pogłębione o analizę dokumentów kontraktowych, analizę interesariuszy, przegląd literatury oraz na podstawie doświadczenia zawodowego autorów artykułu. Za najważniejsze zagrożenia uznano: złe przygotowanie głównego inwestora do realizacji kontraktów, trudności w pozyskaniu map do celów projektowych, opóźnienie w uzgodnieniach dokumentacji projektowej z zewnętrznymi interesariuszami, przyznawanie wykonawcy zamknięć torowych, oraz wpływ wewnętrznych procedur zamawiającego na przebieg kontraktu.

Słowa kluczowe: identyfikacja zagrożeń, ryzyko, inwestycje kolejowe, planowanie przedsięwzięć budowlanych

1. Introduction

In the near future EU funding for improving Member States' infrastructure will no longer be sent to Poland, but will be directed to other, e.g. Balkan, countries. Poland will turn from the recipient of EU assistance to co-financing projects in those countries. At the same time, the possibility of financing domestic investment by PKP PLK S.A., as the only significant investor, can be severely limited. Today, it is necessary to create added value of Polish companies so that they can not only survive on the domestic investment market, but also actively participate in investment projects, also railways, in other parts of Europe or the world. It is unacceptable that international construction companies will close down in Poland, move to other locations, and domestic firms without the necessary technological, financial or logistical potential will be reduced to the role of their subcontractors or suppliers without the possibility of applying for own large infrastructure contracts. Therefore, in order to build railway infrastructure for the next several decades, it is necessary to be able to anticipate the dangers that these investments may face and to adequately prepare for countermeasures. It is also worth emphasizing that the realization of railway facilities has its own characteristics, which at least in part does not concern only works performed under Polish conditions but also in other countries [2, 6, 8, 11, 13, 14] which may soon become the area of activity of Polish construction companies. It is even more vital to analyze the potential risks that must be taken into account when applying for a contract and planning work.

Experiences from the first EU perspective for the years 2007–2013 show that during the implementation of rail investments contractors, both domestic and foreign, encountered a number of previously unresolved problems. Since the prospect of obtaining EU grants for infrastructure investments for the following years is very promising (the amount of PLN 67 billion is planned for 2014–2020 for railway investments alone), all possible remedial measures should be taken to allocate the funds according to the adopted plan. As is known, the investment process can be planned both on the assumption of deterministic and probabilistic conditions, where the risk associated with the occurrence of potential hazards is taken into account at the stage of creating the work schedule. According to data from the previous EU perspective, it can be said that the railway investment in Poland is threatened with many factors, including random ones, which influence the extension of the investment completion date and the increase of the planned cost. On the other hand, the planning and realization of railway investments is marked by a certain character, distinguishing them from other construction works.

In order to minimize the occurrence of unforeseen threats during the implementation of future railway investments and to include them in planning schedules, the authors attempted to identify and show the most likely ones.

2. Hazard identification method

The basic method of identifying the hazards of railway investments in Poland was a case study in depth analysis of contract documents, stakeholder analysis, literature review, and the professional experience of the authors. The hazard identification was mainly developed on

the basis of data from a large railway contract. The contract under test was implemented in accordance with the procedures of the Yellow Book FIDIC, so the contractor was responsible both for the preparation of the design documentation and the execution of the works. This manner of contract implementation influenced its course and the responsibility and involvement of individual participants. The scope of work included the modernization of three railway stations and selected sections of track between these stations, on railway lines owned and used by PKP PLK S.A. The total amount of the gross contract amounted to about PLN 500 million and the planned date of execution is 35 months. The investor of the contract executed was PKP PLK S.A. and the contractor a consortium of four foreign companies. The analyzed contract was a very difficult one (like many other contracts for rail works, especially for modernization works), as the work had to be carried out while maintaining the current passenger and freight traffic throughout the redeveloped section. In the first stage of the attempt to identify threats to its implementation, the authors identified the stakeholders interested in the implementation of the considered contract, and the extent of their impact on the various stages of preparation and implementation.

This research stage is not described in the article. Contract documents were then analyzed, which consisted mainly of tender documents, design documentation, contractual correspondence, contractor and contractor claims. Based on the conducted query, the authors selected these threats, which are likely to occur during the implementation of similar railway investments in Poland, and their effects have a significant impact on the course of contracts. The article focuses only on hazards, whose nature is closely related to the realization of railway investments.

3. Major identified hazards to the performance of railway contracts

3.1. Difficulties in acquiring maps for design purposes

A significant part of the risks to the construction projects, including railway investments, is at the design stage. Since many contracts are made under the FIDIC Yellow Book, the contractor is responsible for the work and for most of the risks associated with this stage of performance. One of the most important, most difficult and less recognized problems that the contractor must face at the time is the process of acquiring maps for design purposes in railroad closed areas.

Preparation of the map for design purposes is of geodetic and cartographic character and is essential for the design documentation. The topicality and accuracy of these maps largely influence the correct course of the whole investment process, especially the quality of the executive documentation being developed. The problem of acquiring maps for design purposes concerns especially investments located in the areas of two neighboring voivodships and / or in the case of combined railways and external areas. Within the Department of Geodesy and Cooperation with Local Governments in PKP SA there are eight field offices of Geodesy and Regulatory Law. Within the faculties exist:

- ▶ Railway Geodetic and Cartographic Reference Centers (KODGiK),
- ▶ Railway Design Documentation Teams (KZUDP) [4].

The geodetic connection of different areas becomes problematic especially when regional railway surveying units (KODGiK) have different requirements for the methods and technical details of map development. Document reconciliation is complicated by the internal procedures of PKP SA and their specificity [1, 3]. Very important at this stage is the cooperation of a qualified surveyor who knows the specifics of measurements on railways and the designer of planned investment there.

In the case of the contract under review, the contractor, in accordance with the Functional and Operational Program (PFU), was obliged to obtain maps for design purposes for the sections of the route. The ordering party was obliged, however, to provide the contractor with maps for design purposes in numerical version, valid for the relevant KODGIK, located in Mazowieckie and Lubelskie voivodeships. However, the documentation submitted by the contracting authority was prepared in an analog version and did not meet the requirements set by KODGIK Lublin. As a result, the contractor was obliged to develop a new map of selected stations. Measurements performed on railway tracks require greater accuracy than those set for open areas, and in addition to the use of different code symbols and graphical signs of objects being loaded. The need to prepare new maps was not, however, included in the tender prepared at the tender stage, and since it turned out to be difficult and time-consuming, it practically stopped the execution of works at two railway stations. The total time that the contractor needed to obtain the above documents ultimately reached 243 days, which constitutes about 23% of the total contract time.

It should be noted that by obliging the contractor to convert analog maps into numerical data, KODGiK updated its data sets without incurring financial expenses. So it is doubtful whether the above actions from individual surveying centers were not intentional. Therefore, in future rail infrastructure contracts, the way and responsibility for acquiring updated maps for design purposes (analogue or digital) should be clearly stated.

3.2. Delay in project design documentation with external stakeholders

Railway infrastructure investments are characterized by the advantage of linear works, partly located in areas not owned by PKP S.A. When designing technical documentation, designers are required to make a number of arrangements with the developers of these sites. External stakeholders are not directly related to the investment and are not interested in finalizing such arrangements as soon as possible. In addition, these arrangements may be significantly prolonged due to previous negative experiences of cooperation with individual branches of PKP S.A. All this means that, when planning a railway investment, special attention should be paid to the extent of the necessary cooperation with the public administration (external stakeholder), and on this basis, to deepen the classification of such risk so that stakeholders not directly involved in the contract do not threaten the planned deadlines.

An example of such threat is the course of the reconciliation of the design documentation of the railway bridge with the manager of the voivodeship road. The contractor, having regard to the requirements set by the contracting authority (PKP PLK) at the tender stage, submitted to the contracting authority the concept documentation of the railway bridge located at the railway station in Lublin province. The contractor established, among others the execution of the object with a vertical gauge of 4.70m. It fulfilled the requirements of the minimum gauge according to the Regulation of the Minister of Transport and Maritime Economy of 2 March 1999. OJ 463.430.

On the basis of the project agreement accepted by the parties, the Construction Project was subsequently developed, which the contractor agreed with the local Voivodeship Road Administration Board (ZDW). However, the Voivodeship Road Administration sent back the submitted documentation without agreeing that it was necessary to raise the vertical gauge to 5.0 m and redesign the facility to gain acceptance. The refusal to agree the submitted project by the Voivodeship Road Administration did not have substantive and technical justifications in respect of legal acts and contractual provisions. The recalled road manager, who was not an investor of this engineering facility, extended the documentation agreement without incurring any consequences. As a result, after many negotiations, the documentation was approved after the contractor introduced some of the pre-requested amendments not included in the contract or not supported by industry regulations. Delay in approving the documentation was 128 days, which made the railway bridge deadline directly affect the deadline for completion of the entire contract.

3.3. Awarding contractor track closures

Railway investments, which predominantly involve the modernization of existing routes, can most often be carried out under the pain of providing contractors with liquidity of train traffic on the area of work. To this end, contractors are obliged to develop detailed schedules of planned track closures and on their basis to apply for long-term, periodic or temporary closures, but the application definitely does not guarantee its acceptance. If the proposal for such closure is nevertheless approved, it does not mean that it will actually be implemented. After all, keeping scheduled closures is crucial to the smooth running of the work and the timely completion of the investment. Unfortunately, practice shows that it is relatively common to change or cancel agreed closure times, with no effect on the contractor. In the event that it is not possible to grant a planned track closure, a special PKP S.A. unit may propose to change the closing date, shorten the allocated time, or cancel it completely. Unfortunately, an attempt to compensate for the cancellation of track closures by changing deadlines or allocating more of them, but with less time, ruins the schedule and does not guarantee the same efficiency. The consequence of such a situation is usually the serious delay of the works and the need for the contractors to incur additional, often costly, downtime and additional mobilization of specialized construction equipment, work crews, etc. In addition, if the contractor fails to comply with the deadline for completion of works, he will be charged for any losses and lost revenues of PKP SA as a consequence of such an event. Unfortunately, the financial loss due

to the change of planned track closures is charged only to one side of the contract, because in internal PKP Instruction (IR19, §11) there is no mention of payment of lost contractor benefits if the planned closure is shortened or completely canceled not from his fault.

On the subject of investigation, cases of receiving much shorter track closure times than those requested by the contractor were frequent. Of the 56 closures requested, only 12 cases were awarded to the contractor for the closure of the track according to the submitted application. It should be borne in mind that almost every track closure requires the necessary preparatory work. The execution time of these works is included in the time of the closure granted, and every time the voltage is cut off in the network, the costs incurred by the contractors are borne by such contractors.

3.4. Difficulties in the implementation of works related to the encounter with non-inventoried underground infrastructure and other hidden obstacles

In Poland railway areas have been undergoing serious investment for many decades. Therefore, one of the major problems faced by contractors in these areas is the long-standing negligence of the underground infrastructure inventory that is actually occurring there. This applies in particular to areas where stations or railway junctions are located, but also, to a lesser extent, to track routes. At work almost every stage of the works is damaged by existing underground installations such as water supply, sewage, gas, telecommunication lines and rail traffic control systems. Any such event results in interruptions in work, the need to perform unplanned additional work, creates a danger to the traffic that is taking place, causes interruptions and delays in rail transport or the need to arrange for replacement transport. In addition, such events often result in financial penalties for the contractor for causing interruptions in the delivery of media or communication systems.

An important threat, sadly quite common, is also encountering hazardous materials of military origin (such as unexploded ordnance). It should be borne in mind that the modernized railway tracks were most frequently exploited during the last two world wars, and these areas also served as warehouses for various types of military equipment, including explosives and ammunition. Some of these materials have never been removed, are buried and unlisted until today, and are a real threat when carrying out construction works, especially earthworks. Another type of threat, which results in temporary suspension of earthworks, is the opportunity to encounter archaeological sites. This is particularly the case when the modernization works are carried out by extension or relocation of existing railway facilities.

During the query of documents of the analyzed contact the authors encountered evidence that the problem of damage to non-inventoried underground installations and encountering explosives also concerned the examined object. The contractor encountered, among other things, very large compositions of materials of military origin, which, due to the safety of health and the lives of the people working there, forced him to break groundwork and carry out a thorough excavation. This resulted in delayed work, increased costs and disturbed liquidity of the current train traffic.

3.5. The impact of the contracting party's internal procedures on the contract

In planning the possibility of efficient performance of railway contracts in our country, it is vital to take the dominant position of the principal contractor, PKP PLK S.A into account. This is a very specific investor, maintaining a monopoly position in terms of disposing and modernizing railway infrastructure for a number of years. During this time, PKP PLK S.A implemented a series of own procedures and instructions regulating the way of preparing and performing works on railway objects, which are often not integrated with regulations and techniques of realization of general construction projects. Contractors, especially foreigners, accustomed to the implementation of construction investments, eg according to the FIDIC rules are not always aware of the requirements set for by PKP PLK S.A. during the execution of the contract. This particularly concerns the stage of design and preparation of investment for implementation. A good example here is the need to reconcile project documentation with the internal organizational unit of the contracting entity; the Investment Project Evaluation Team (ZOPI). ZOPI is obliged and authorized to agree and accept design solutions for all rail investments. The primary purpose of the Team is to assess whether the work submitted for the review has been done in accordance with contractual terms as determined by the contracting authority. The Team evaluating the submitted studies verifies their completeness and conformity with the description of the object of the order and their conformity, among other things, with the applicable regulations, industry instructions and regulations in force at PKP PLK S.A. The lack of positive opinion of the Team is the basis for blocking the signing of the acceptance protocol confirming that the contractor performed in whole or in part the subject matter of the contract. It should be noted that ZOPI is not a party to the contract and does not need to be interested in its smooth running, but may significantly affect its performance.

4. Summary and conclusions

The aim of the article was to carry out the process of identifying the basic sources of danger that may arise during the implementation of railway investments. Only those hazards that are due to the specific nature of such objects were taken into account, without including the risk sources typical of construction works (design errors, equipment failures, weather, etc.), and which, according to the authors, are highly likely to occur and result in serious financial losses and threaten meeting the deadline of the contract. Railway investments in the coming years will be carried out on a large scale, with significant financial resources, including EU grants. In this context, the proper preparation of these investments for implementation is of great importance. This concerns many aspects of the entire investment process such as: access to the land on which these investments will be made, design documentation, contractor selection, contract form, funding in the context of progress and more. Railroad works are of a very difficult nature, for example by combining construction work with the maintenance of a modernized railway track. However, the prime importance for the efficiency of the entire investment process is well prepared by the main investor of these contracts i.e. PKP PLK S.A.

to fulfill their duties. Unfortunately, as can be read in the trade literature [5, 7, 9, 10, 12], and from the information obtained during analysis of contract tracking documents, irregularities in preparation and during the execution of the investment by PKP PLK S.A. are significant and should be definitely improved.

The topic discussed in the article is, according to the authors, crucial to the success of the railway contracts in the near future and should be further researched.

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