

PRACE NAUKOWO-PRZEGLĄDOWE RESEARCH REVIEW PAPERS

Scientific Review – Engineering and Environmental Sciences (2018), 27 (1), 71–81
Sci. Rev. Eng. Env. Sci. (2018), 27 (1)
Przegląd Naukowy – Inżynieria i Kształtowanie Środowiska (2018), 27 (1), 71–81
Prz. Nauk. Inż. Kszt. Środ. (2018), 27 (1)
<http://iks.pn.sggw.pl>
DOI 10.22630/PNIKS.2018.27.1.7

**Agnieszka LEŚNIAK¹, Grzegorz PISKORZ², Marcela SPIŠÁKOVÁ³,
Daniela MAČKOVÁ³**

¹Faculty of Civil Engineering, Cracow University of Technology

²PhD student of Cracow University of Technology

³Faculty of Civil Engineering, Technical University of Kosice

Causes of delays in construction works resulting from the provisions of the contract in Poland and Slovakia

Key words: construction works, delays factors, contractors, questionnaire survey

Introduction

Exceeding the time limit of works implementation specified in the contract is a common problem in the construction industry and is significant for both the investor and the contractor. As shown by studies conducted in developed and developing countries, delays in construction works are a common and frequently recurring problem in the implementation of construction projects (Toor & Ogunlana, 2008). For the investor, a delay may mean the inability to obtain benefits of the investments at the scheduled time, and in special situations, it may turn a profitable venture into an unviable project. For the contractor, this

may mean higher than planned costs of works. In extreme cases this can lead to a situation in which, instead of planned profit, the contractor incurs losses. The provisions of the agreement between the investor and the contractor decide which party is going to be responsible for delays. On these grounds, the way the risks related to the implementation of construction works are distributed between the parties is established. Early identification and the subsequent limitation or even elimination of the potential reasons for such delays may contribute to the efficient and punctual project completion.

The paper presents the results of research dealing with building contractors in Poland and Slovakia. The aim of the research was the identification and rating the significance of factors that may generate delays in construction works in both countries. The authors compared

the results and proposed a classification of factors which they predicted likely to be identified as early as at the stage of procedures preceding the signing of the contract and which result from the provisions of the agreement.

Causes of delays in construction works in previous research

Some of the first studies of the causes of delays in construction works were carried out in the 1970s in the United States (Baldwin, 1971). Seventeen factors causing delays were specified. These included: weather conditions, availability of labour, participation of subcontractors, design changes, quality of design documentation, foundation conditions, availability of materials, equipment failures, execution errors, construction inspections, financial issues, obtaining relevant permits and others. Further research locations included, among others: the United Kingdom (Lim & Mohamed, 2000), Saudi Arabia (Al-Kharashi & Skitmore, 2009), Malaysia (Sambasivan & Soon, 2003) or Thailand (Toor & Ogumiana, 2008). As a result of more frequent and more extensive studies, new delay factors were identified. Ultimately, more than a hundred of them were listed and in order to systematize, all of them began to be grouped together. When analysing the latest results of research on the factors causing worldwide, it is worth noting that the problem of delays is a commonly occurring phenomenon and the reasons that cause it are similar. Table 1 summarizes some results of studies conducted in recent years in the world.

The most frequent opinion holds that the completion of facilities is often entrusted to companies that do not have the necessary experience, staff or management. Another important group of factors are those related to the facility's design documentation. These include errors in the documentation and design solution modifications implemented at the request of the investor. The next group includes problems in raising funds for further execution of investment and applies to both the contractor and the investor. Other most frequently mentioned factors included the following: slow decision-making by the investor, unrealistic project schedules.

The analysis of Polish literature reveals that a lot of the research conducted so far concerned the identification of factors that generated delays in the completion of construction works. The publications of Anysz and Zbiciak (2013); Czarnigowska and Sobotka (2013); Głuszak and Leśniak (2015) and Leśniak and Piskorz (2017) involve attempts made by various researchers to identify the factors influencing works delays in the opinion of contractors. Work by Leśniak (2012) proves that, according to contractors, the most significant factors that generate delays include mistakes in project documentation, the investor's slow decision-making process and a low quality of management and supervision of the construction site. However, according to Anysz and Zbiciak (2013) the most vital factors include a large number of mistakes in project documentation, poor cooperation between the investor and the contractor and adverse weather conditions. In the work of Czarnigowska and Sobotka (2013), concerning road in-

TABLE 1. Main factors causing delays in selected countries – the latest results of research

Country	Source	Factors
Saudi Arabia	Al-Kharashi & Skitmore, 2009	1) suspension of work by the investor 2) lack of experience of the contractor 3) slow decision-making by the investor
Thailand	Toor & Ogumiana, 2008	1) lack of a unified form of projects 2) lack of experience of the contractor 3) hiring untrained workers
Malaysia	Sambasivan & Soon, 2007	1) ineffective planning 2) poor quality of on-site management 3) insufficient experience of the contractor
Hong Kong	Lo, Fung & Tung, 2006	1) lack of resources to finance investment 2) unforeseen land conditions 3) offers underpriced in relation to the value of the works
United Arab Emirates	Faridi & El-Sayegh, 2006	1) too much time taken to prepare documentation 2) manpower shortage 3) slow decision-making by the investor
Turkey	Kazaz, Ulubeyli & Tuncbilekli, 2012	1) design and material changes 2) delay of payments 3) cash flow problems
Poland	Leśniak, 2012 Anysz & Zbiciak, 2013	1) mistakes in project documentation 2) the investor's slow decision-making process 3) low quality of management/adverse weather conditions

vestments, additional works and changes in the project were described as the actual cause of the delay in the analysed investments. The paper by Jaśkowski and Biruk (2010) analysed the results of the research into the time risk factors in Poland. Some of the Polish publications also present the possibilities of applying various methods to analyse delay-causing factors: using the Dematel method (Dytczak, Ginda & Wojtkiewicz, 2011), factor analysis (Głuszak & Leśniak, 2015) or propose models and methods that can be used to effectively and reliably estimate the time of implementation of construction projects (Skorupka, 2008; Połowski & Pruszyński, 2013; Ibadov & Kulejewski, 2015; Krzemiński, 2016).

The research that focused on the identification of factors that generated delays in the completion of construction works was not yet carried out in Slovakia. This issue is solved only in the work of Mackova, Kozlovska, Baskova, Spisakova and Krajnikova (2017): terms of the relationship between construction time and other construction parameters related to gross floor area, number of stories and floor area of one storey.

These works represent the increase of the interest in the problem of delays in construction works and the reasons for their occurrence. They prove that the problem is common and the risk of delays during the implementation of a building project is high.

The aim of the paper is identification, assessment and comparison of delay-causing factors based on the research dealing with building contractors in Poland and Slovakia. The authors proposed factors which they predicted likely to be identified as early as at the stage of procedures preceding the signing of the contract and which result from the provisions of the agreement.

Research methodology

The aim of this research was to show the reasons for delays in construction works according to building contractors, resulting from the provisions of the agreement. The research was performed at the beginning of 2017. The selected method of research was a computer questionnaire survey because of its low cost

and time-efficiency. A questionnaire was prepared through a modern Internet platform (Profitest.pl in Poland and Survio.com in Slovakia) which enables preparation of on-line surveys. Figure 1 presents a part of the questionnaire.

The relevant link was sent in total to 791 respondents – building contractors (462 in Poland and 329 in Slovakia). The response rate of the survey was 21% in Poland and 16% in Slovakia (Table 2). A total of 160 fully completed questionnaires were obtained. It is very difficult to define a satisfactory rate of return in questionnaire research method. The degree of completeness of questionnaires determines whether the data obtained from surveys can be included in the study. The authors assumed that a 10% return rate in on-line questionnaire survey would provide sufficient results for analysis. Authors did not vary the types

The screenshot shows a digital questionnaire interface. At the top, there is a header 'Project Documentation'. Below it, two items are listed, each with a five-point scale for 'Importance' and 'Frequency'. The first item is 'lack of a complete building permit design or a detailed design', and the second is 'lack of a complete geology report'. The scales are represented by numbered circles from 1 to 5.

FIGURE 1. The printout of a part of the questionnaire (own elaboration)

TABLE 2. The distribution of the questionnaire and response rate (own studies)

Specification	Poland	Slovakia
Number of sent out questionnaire	462	329
Number of returned questionnaire	97	52
Response rate [%]	21	16

of questionnaires (e.g. telephone, mail or face-to-face interview), which could increase the percentage of respondents, mainly due to financial constraints.

The questionnaire consisted of two parts. The first one included three questions concerning the professional experience of the participant and the company.

Sample profile

The greatest number of the Polish respondents (62%) were engineers with over 10-year experience. More than a half (52%) represented large companies employing over 250 people. The operating range of the respondents' businesses included both the domestic market (44%) and the international market (46%). In Slovakia, 92% respondents were engineers with over 10-year experience. Companies participating in research accounted for 39% large company (over 250 people) and 33% small

company (10–49 people). The operating range of the respondents' businesses included both the domestic market (45%) and the international market (44%) and it is similar like in Poland. The detailed characteristics of companies that took part in the survey is presented in Table 3.

The second part of the questionnaire contained 20 factors found in the provisions of the agreement that can cause delays in construction works. They were assigned to six groups, namely: 1 – project documentation; 2 – administrative decisions; 3 – changes in law; 4 – construction site; 5 – works planned in winter; 6 – social conditions. The respondents assessed the value of each factor by choosing a relevant number on a five-point scale: 1 – unimportant; 2 – of little importance; 3 – of average importance; 4 – important; 5 – very important. Then, for each factor, an average evaluation was calculated.

TABLE 3. Characteristics of respondents (own studies)

Companies' size according to the number of employee [%]				
Country	micro company (< 9)	small company (10–49)	medium company (50–249)	large company (> 250)
Poland	17.5	11.3	19.6	51.5
Slovakia	17.3	32.8	11.5	38.5
Companies' region of operation [%]				
Country	international	national	local	
Poland	46.8	44.1	9.8	
Slovakia	44.2	32.7	23.1	

Evaluation of factors – research results analysis

For the contractor, project documentation is essential. It decides on the scope of the planned works and becomes the basis for the agreement. It is one of the elements that influence the shape of the tender. This group includes the following factors: (1) lack of a complete building permit design or a detailed design; (2) lack of a complete geology report; (3) lack of a complete stocktaking or identification of underground networks, and (4) lack of a complete description of the order. The ranking on the basis of the average assessment of the importance of the given factors was created (Fig. 2).

In both countries the highest evaluation was granted to the factor lack of a complete building permit design or a detailed design. In the evaluation of factor (2), complete geology report, one will notice differences in the average rating depending on the country, yet in both it is considered to be the most likely cause of delays in this group. Still, the difference from the remaining factors in Poland and Slovakia is small. The evaluations of all

the factors in this group are about 3 or 4; therefore, it can be concluded that the factors in this group are rather important reasons for delays in construction works in Poland and of average importance in Slovakia.

Before the investment receives the final building permit, it is necessary to obtain a number of agreements and permits, hence the next group proposed is administrative decisions with the following factors: (1) not issuing within the statutory period the appropriate decision of; (2) mistakes in permits or in decisions required for the implementation of the subject of the order; (3) the expiry of the agreement validity, and (4) the risk of delays related to the limitations resulting from the provisions of the administrative decisions. A ranking on the basis of the average assessment of the importance of the given factors was created (Fig. 3).

The highest evaluation in Poland was granted to factor (1) – not issuing the appropriate decision within the statutory period. The same factor in Slovakia had one of the one of the lowest rates. Also, other factors of this group are evaluated lower by the Slovakian contractors, thus oscillating around the rating 3. This may

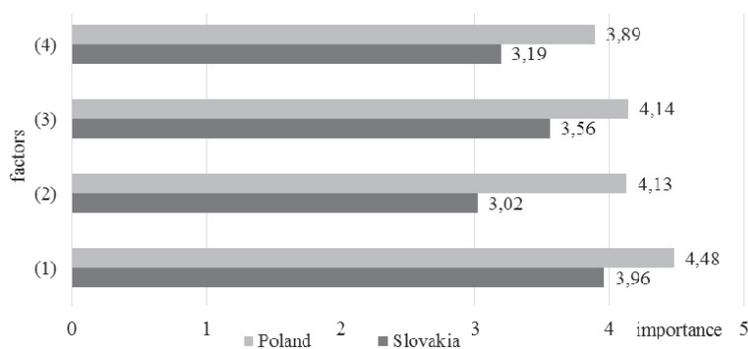


FIGURE 2. Importance of project documentation factors (own studies)

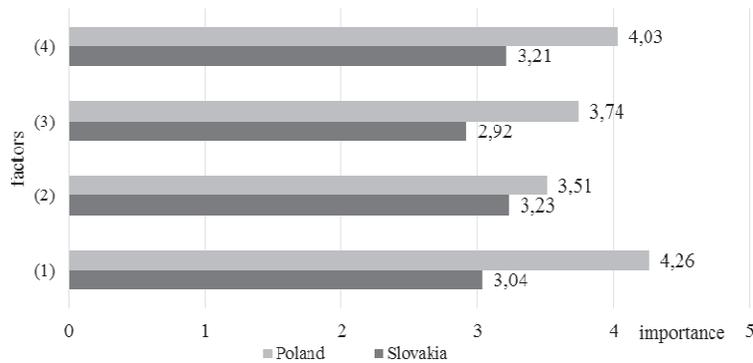


FIGURE 3. Importance of administrative decision factors (own studies)

also indicate that they are probably less likely to generate delays in Slovakia. In Poland, most of the contractors consider the factors of this group as important and likely to cause delays.

The project must comply with the regulations in force at the time of the ordering party's construction works acceptance. References in the contract to the published standards are regarded as references to the issue of the current contract on the date of the tender submission, unless the contract states otherwise. In the case of the new or revised national standards coming into force after the date of submission (that is, during the tender contract implementation), the ordering party makes a decision about ensuring compliance with such standards. Therefore, a group called Changes in law has been proposed, including such factors as: (1) changes in nature conservation regulations; (2) changes in the energy law; (3) changes in geodetic and cartographic regulations; (4) changes in the geological law and (5) changes in environmental regulations. The group does not include changes in the law concerning design technical standards. In the traditional method for the project delivery, known

as the design-bid-build method, at the investment process stage analysed by the authors (before the bidding phase), design documentation is prepared in accordance with current technical standards. The ranking of proposed five factors was shown in Figure 4.

The average evaluation of the factors in this group is about 3 and less, which means that the respondents from both countries consider the problem related to changes in law as average or of little importance. The Polish contractors evaluated the importance of the factors slightly higher. In addition, they pointed out other factors that could cause delays and belong to this group but were not included in the survey: changes in the project due to the imprecise provisions in the permission for the implementation of a road project and changes in the tax legislation.

A vital stage for the timely start of the project is transferring the building site within the contractually prescribed period. Failure to transfer it for reasons attributable to the ordering party or other, beyond the contractor's control, generates delays. Therefore, a group called construction site was proposed,

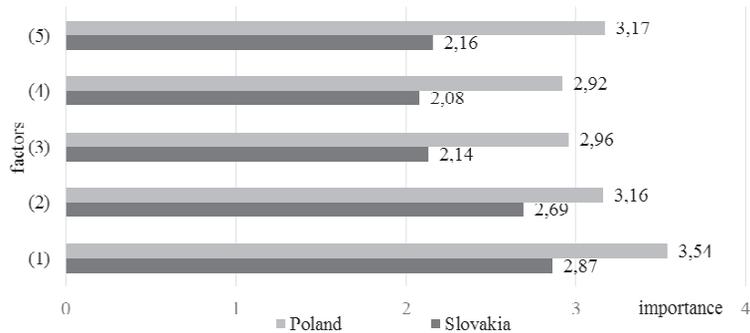


FIGURE 4. Importance of changes in law factors (own studies)

consisting of three factors: (1) having no right to administer the area for construction purposes on the part of the investor; (2) lack of possibility to begin works due to the presence of places of worship at the construction site, for example, shrines; (3) lack of access to part of the site due to undocumented environmental conditions or unregulated development areas. The ranking on the basis of the average assessment of the importance of the given factors is presented in Figure 5.

The answers provided by the Polish respondents reveal that having no right to administer the area, whole or a part of it, for construction purposes on the part of the investor is the highest-ranking factor that may cause delays. In Slovakia, for contractors, all factors in this group

were similarly evaluated. They did not indicate the most important factor.

Planning construction works in winter requires taking into consideration adverse weather conditions that could influence the time of completion the subject of the order. This is the only group that consists of only one factor. Here, the respondents did not propose any other factors, yet they did pay attention to the reasons for such works planning by the ordering party. This group (and a factor at the same time), named works planned in winter, received a very similar, average evaluation in both countries (Fig. 6): 3.89 in Poland and 3.96 in Slovakia, which means that it is important as a potential reason for delays.

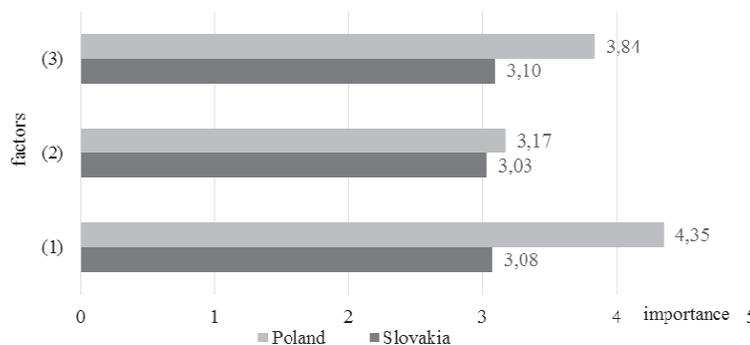


FIGURE 5. Importance of construction site factors (own studies)

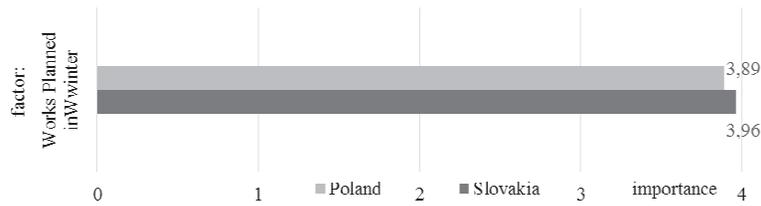


FIGURE 6. Importance of the factor works planned in winter (own studies)

Protests of residents or blocking entrance to the construction site by various organizations have a significant influence on the occurrence of delays in construction works. Therefore, the authors proposed a group Called social conditioning with three basic factors: (1) the possibility of constraints and difficulties in accessing the building site; (2) possible protests of residents living in the area neighbouring the construction site, and (3) possible protests related to environment protection.

The average evaluations of the factors in this group range between 3 to 4 points, therefore the problem of social conditioning was judged as important by the Polish contractors (Fig. 7). Contractors in Slovakia assessed the factors of this group closer to evaluation 2, which means that in their opinion their influence is small and that they are an insignificant cause of delay.

Conclusions and discussion

The present study involves factors that can cause delays of construction works that the authors judged as possible to identify before concluding the contract and which result from the provisions of the agreement. The classification of factors into six groups was proposed. In total, 20 factors were indicated.

The analysis of the results obtained one can notice that for Polish contractors three groups out of six, namely: project documentation, administrative decisions and construction site contain factors of importance over 4 points, meaning that they are perceived as important potential causes of delays. The values of importance factors provided by the Slovakian contractors are in most cases 1 point lower than those in Poland. In Slovakia, the greatest importance was assigned to the factors belonging to the group

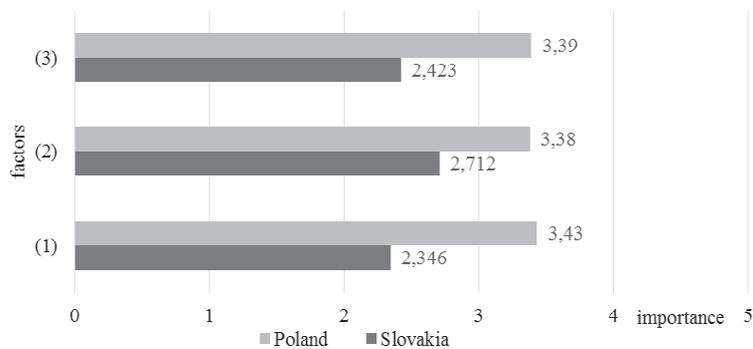


FIGURE 7. Importance of social conditioning factors (own studies)

called Project documentation. The factors named lack of a complete building permit design or a detailed design were assessed as the most significant possible generator of works delays. The influence of this factor could be significantly reduced by using BIM (building information modeling) at the project planning phase. Transparency of the 3D model (which is the basis for the use of the BIM technology) does not leave any doubts as to the content of the project documentation. Any shortcomings, errors and incompatibilities in the project are immediately visible and can be quickly corrected by the designers. Building information model allows us to understand the building before its construction even begins, as well as to spot errors in the design before its implementation (Zima, 2017). Working on a 3D model, all technical aspects of the planned implementation can be virtually checked before construction works begin. Investors and designers can observe the progress of design works and supervise the design process due to the access to the current 3D model of the project. For the contractor, the use of BIM technology not only helps in execution of contracts, but also allows avoiding errors at the stage of bidding process and preparing the commencement of the construction project. The factor called works planned in winter needs to be emphasized. This is the only factor that was almost identical in both countries and it was definitely regarded as a grave cause of the delay in construction. Without doubt, this factor should be added to the group of unpredictable factors since it is related to weather difficulties, which are hard to foresee. Nevertheless, research shows

that, when signing contracts, contractors of both countries should pay special attention to the necessity of performing works in winter. Proper early preparation and planning of activities can reduce the risk of delays alone, as well as reduce their effects.

References

- Al-Kharashi, A. & Skitmore, M. (2009). Causes of delays in Saudi Arabian public sector construction projects. *Construction Management and Economics*, 27(1), 3-23.
- Anysz, H. & Zbiciak, A. (2013). Przyczyny powstawania opóźnień w realizacji kontraktów budowlanych – analiza wstępnych wyników badania ankietowego. *Autobusy: Technika, Eksploatacja, Systemy Transportowe*, 3, 963-972.
- Baldwin, J.R. & Manthei, J.M. (1971). Causes of delays in the construction industry. *ASCE Journal of the Construction Division*, 97(2), 177-187.
- Czarnigowska, A. & Sobotka, A. (2013). Time–cost relationship for predicting construction duration. *Archives of Civil and Mechanical Engineering*, 13(4), 518-526.
- Dytczak, M., Ginda, G. & Wojtkiewicz, T. (2011). Identyfikacja roli czynników opóźnień realizacji złożonych przedsięwzięć budowlanych. *Budownictwo i Inżynieria Środowiska*, 2, 481-485.
- Faridi, A.S. & El-Sayegh, S.M. (2006). Significant factors causing delay in the UAE construction industry. *Construction Management and Economics*, 24(11), 1167-1176.
- Głuszak, M. & Leśniak, A. (2015). Construction delays in clients opinion – multivariate statistical analysis. *Procedia Engineering*, 123, 182-189.
- Ibadov, N. & Kulejewski, J. (2015). Evaluation of the project timeliness with fuzzy constraints, International Conference of Numerical Analysis and Applied Mathematics (ICNAAM-2015). *AIP Conference Proceedings*, 1648(1), 600002.

- Jaśkowski, P. & Biruk, S. (2010). Analiza czynników ryzyka czasu realizacji przedsięwzięć budowlanych. *Czasopismo Techniczne, Budownictwo, 1-B(2)*, 157-166.
- Kazaz, A., Ulubeyli, S. & Tuncbilekli, N.A. (2012). Causes of delays in construction projects in Turkey. *Journal of Civil Engineering and Management*, 3, 426-435.
- Krzemiński, M. (2016). KASS v.2.2. Scheduling Software for Construction with Optimization Criteria Description. *Acta Physica Polonica A*, 309(6), 1439-1442.
- Leśniak, A. (2012). Przyczyny opóźnień budowy w opiniach wykonawców. *Czasopismo Techniczne, Budownictwo, 1-B(2)*, 57-68.
- Leśniak, A. & Piskorz, G. (2017). Potential reasons for works delays resulting from the provisions of the agreement. *Technical Transactions*, 6, 135-143.
- Lim, C.S. & Mohamed, M.Z. (2000). An exploratory study into recurring construction problems. *International Journal of Project Management*, 18(3), 267-273.
- Lo, T.Y., Fung, I.W.H. & Tung, K.C.F. (2006). Construction delays in Hong Kong civil engineering projects. *Journal of Construction Engineering and Management*, 132(6), 636-649.
- Mackova, M., Kozlovska, M., Baskova, R., Spisakova, M. & Krajnikova, K. (2017). Construction-duration prediction model for residential buildings in Slovak Republic based on computer simulation. *International Journal of Applied Engineering Research*, 12(13), 3590-3599.
- Połośki, M. & Pruszyński, K. (2013). Impact of baseline terms on the course of critical paths and time buffers in the modified Goldratt's method. *Archives of Civil Engineering*, 59 (3), 313-320.
- Sambasivan, M. & Soon, Y.W. (2007). Causes and effects of delays in Malaysian construction industry. *International Journal of Project Management*, 25(5), 517-526.
- Skorupka, D. (2008). Identification and initial risk assessment of construction projects in Poland. *Journal of Management In Engineering ASCE*, 24(3), 120-127.
- Toor, S. & Ogunlana, S.O. (2008). Problems causing delays in major construction projects in Thailand. *Construction Management and Economics*, 26(4), 395-408.
- Zima, K. (2017). Index cost estimate based BIM method – Computational example for sports fields. *AIP Conference Proceedings*, 1863, 230015.

Summary

Causes of delays in construction works resulting from the provisions of the contract in Poland and Slovakia. Any construction project, even one that is excellently planned and organized, is prone to the risk of unforeseen events and problems, which in effect can cause late completion of works. The paper presents the results of the research conducted among Polish and Slovakian building contractors. One attempt was to identify and assess the potential causes of delays in the construction works resulting from the provisions of the contract. The knowledge of these factors can help contractors to take protective measures, reducing the risk of delays during the implementation of construction works.

Authors' addresses:

Agnieszka Leśniak
 Politechnika Krakowska
 Wydział Inżynierii Lądowej
 31-155 Kraków, ul. Warszawska 24
 Poland
 e-mail: alesniak@izwbit.pk.edu.pl