

An Analysis of Major Construction Disasters in Poland

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Abstract

Exploring the Spectrum of Construction Catastrophes: A Comprehensive Study of Diverse Incidents Across Varied Projects in Poland Since the Post-World War II Era. Construction catastrophes, encompassing a wide array of incidents spanning diverse construction projects regardless of their intended function, scale, technological intricacies, or phases of development, warrant meticulous investigation. These occurrences, occurring during both construction and operational phases, underscore the significance of identifying underlying causes to enhance safety and risk management practices. In this pursuit, this scientific endeavor delves into the intricate realm of construction disasters that have transpired within the geographical boundaries of Poland subsequent to the Second World War. By meticulously examining these instances, this paper endeavors to shed light on the multifaceted factors that contributed to their unfolding. Through rigorous analysis, it seeks to unravel the underlying elements, encompassing engineering flaws, material limitations, regulatory oversights, and human mistakes, which collectively or in isolation, led to these prominent mishaps. Through an amalgamation of empirical data, historical context, and contemporary discourse, this study seeks to not only comprehend the individual incidents but also to extract overarching patterns and lessons learned. By synthesizing these findings, the research aspires to contribute to the broader discourse on construction safety, resilience, and preventive strategies. Ultimately, this investigation strives to equip stakeholders, including engineers, policy makers, and construction professionals, with a more comprehensive understanding of the factors that can precipitate catastrophic events in construction projects, thus paving the way for a safer and more secure built environment in Poland and beyond.

Keywords: construction catastrophes, construction disasters, risk management, safety

1. Introduction

Construction disasters involving the unforeseen destruction of buildings or parts thereof are undesirable events (resulting from various causes), occurring accidentally in the construction industry, from the beginning of the human construction activity to the present time. Construction disasters may concern:

- all types of construction works regardless of their purpose, size, technology, construction time and may occur during their construction and operation, and
- of all countries, regardless of their level of socio-economic development.

The scale of the problem is evidenced by the frequency of these adverse events expressed in their number over the year and the direct and indirect effects caused, determined by the number of victims and the extent of material losses.

Due to the significance of construction disaster events for human life and the need to eliminate them, or at least reduce the number of their occurrence, the issues of construction disasters are the subject of numerous publications in Poland, which explain the definition of this concept adopted in the law, the rules for the qualification of such an event, the requirements for the conduct of owners (managers) of buildings and construction supervision authorities after its occurrence. Hence the great interest of the construction environment in descriptions of examples of construction disasters, the results of analyses of the causes and circumstances of such events occurring in Poland - made in the Central Office of Building Supervision.

The investigation of the causes and circumstances of construction disasters is conducted by the construction supervision authorities of the first instance. It should be emphasized that in cases of major construction disasters, higher-level authorities (provincial inspectorate of construction supervision - in relation to subordinate district building

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supervision inspectors) and the Chief Inspector of Building Supervision - in relation to provincial and district building supervision inspectors) may take over the investigation (Article 77 of *the Construction Law Act*) on determining the causes and circumstances of the construction disaster in question.

This article describes the biggest construction disasters that occurred in Poland in the period after World War II.

2. Legal situation, classification and causes of a construction disaster

Events of construction disasters always occur in one of the following legal situations related to:

- carrying out construction works in a newly constructed or existing building in accordance with the requirements of the provisions of the Pb Act (building permit held, notification of intention to perform construction works, execution of construction works in accordance with the provisions of Article 5 of the Pb Act, etc.);
- carrying out construction works in a newly constructed or existing building in violation of the provisions of the Pb Act (without the required building permit, without notifying the intention to perform construction works, in violation of the conditions of the building permit, in violation of the provisions of Article 5 of the Pb Act, etc.);
- use of a building in violation of the provisions of the Pb Act (without the required notification of completion of construction works or without the required occupancy permit);
- the use of the building in accordance with the purpose specified for that work;
- the use of the construction work contrary to the purpose specified for that work;
- non-use of a construction work that has been excluded from use due to the safety risk posed or for other reasons (by decision of the competent authority or the will of the owner or manager of the facility).

In the analyses of construction disasters carried out at General Office of Building Control, construction disaster events were divided into two categories:

1. Disasters not resulting from acts of God, and
2. Disasters resulting from fortuitous causes, which include catastrophes resulting from:
 - the forces of nature (floods, strong winds, heavy snow, lightning strikes) as well as
 - fires, gas explosions, vehicle hits of buildings, explosions of central heating boilers, etc.

The causes of construction disasters can be divided into objective causes and subjective causes (Fig. 1).

Construction disasters not resulting from random causes are caused by errors made at individual stages of the construction process:

1. Mistakes made during the design of the object most often concern:
 - improper acceptance of loads (value, direction, time of impact), static scheme, geotechnical conditions and material solutions, drawing solutions and calculation justifications (calculation errors),
 - the preparation of opinions or expert opinions used in the design and examination of the design.
2. Mistakes made during the conduct of construction works related to the construction of a new building and related to existing construction works, most often consisting in a deviation from:
 - construction project;
 - principles of building art;
 - the required technology of performing construction works, etc.
 - principles of proper operation – consisting in the violation of obligations by participants in the construction process;
 - rules on the use of construction products, and
 - random events occurring in the process of conducting construction works.
3. Mistakes made at the stage of operation of buildings leading to construction disasters most often concern:
 - a. Mistakes made during the operation of the above-mentioned facilities related to their use and most often concern:

- use of the construction work contrary to its intended purpose;
 - illegal change of use of a construction work or part thereof;
 - illegal reconstruction of a building.
- b. Mistakes made during the operation of the above-mentioned facilities related to their maintenance and most often concern:
- admission to poor technical condition of the building;
 - failure to carry out periodic inspections (or improper inspections) of the construction work;
 - failure to take the required action by the owner or manager resulting from periodic inspections of the construction work;
 - failure to take the required actions by the owner or manager resulting from technical studies concerning the construction work;
 - failure to perform obligations by the owner or manager resulting from the actions of construction supervision authorities.

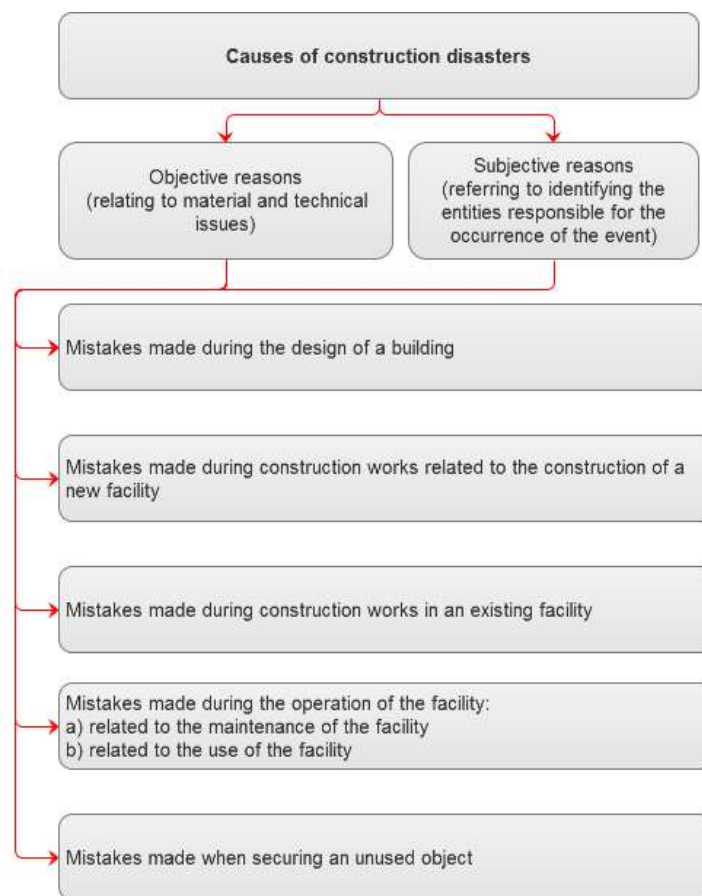


Figure 1. Causes of construction disasters

3. The scope of analysis of construction disasters in Poland

In Poland, despite the creation of a system of construction law regulations aimed at limiting the number of these adverse events, unfortunately we are still not able to completely eliminate them.

The register of construction disasters kept by the General Office of Building Control shows that in the years 1995-2020 there were 8441 construction disasters in Poland. General Office of Building Control analyzes the causes and circumstances of construction disasters to the extent specified in Fig. 1.

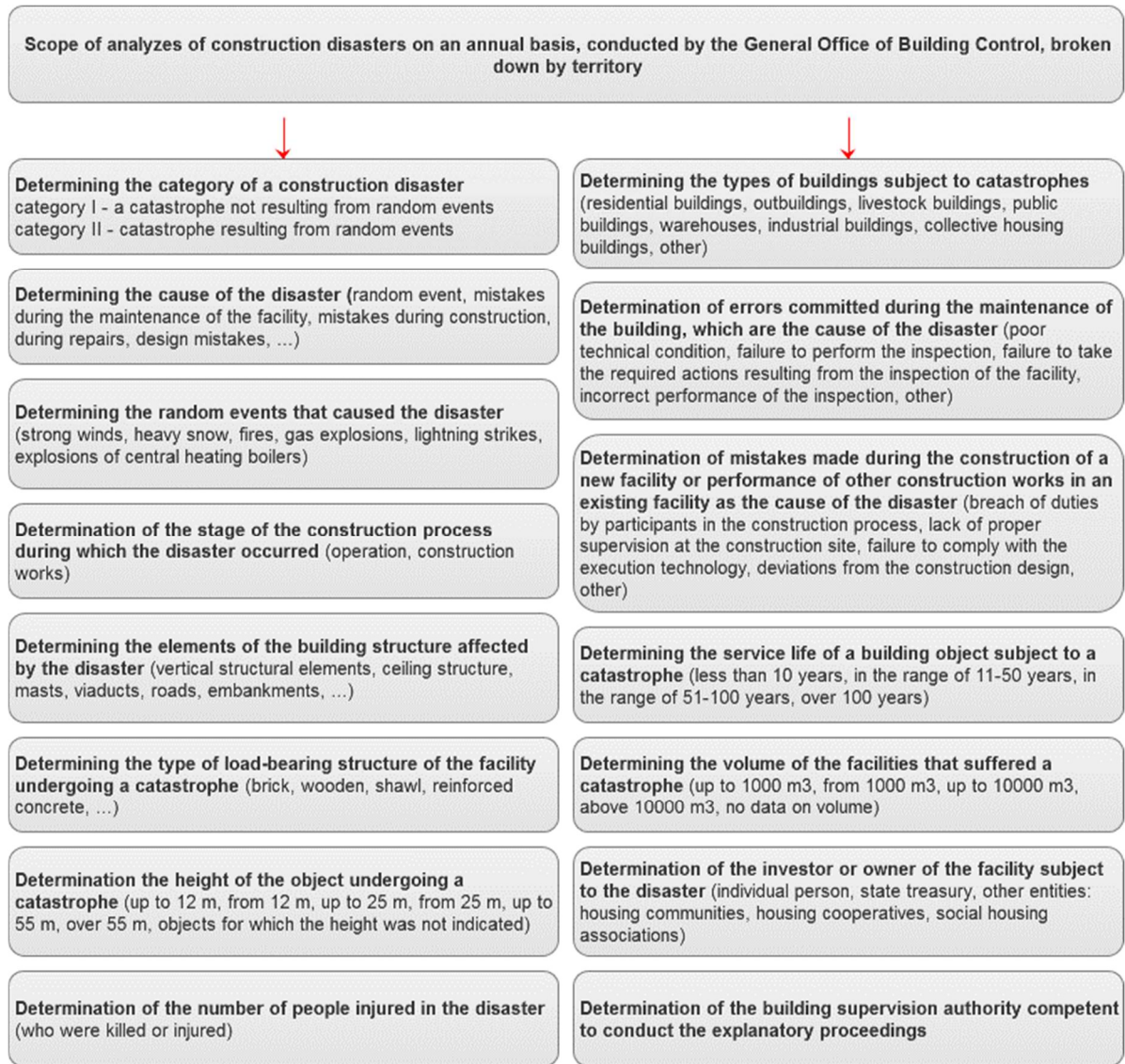


Figure 2. The scope of analysis of construction disasters

The analyses carried out (Fig. 2) show that the majority of construction disasters occur in the process of operation of buildings; Many of these disasters were caused by:

- uncontrolled destruction of facilities, resulting from negligence in the implementation of statutory obligations by owners and managers of buildings, related to underestimating the threat to objects and therefore failure to control their technical condition and omissions in undertaking maintenance and renovation activities;
- accelerated degradation, resulting from failure to take into account all factors of destruction or inaccurate assessment of environmental impacts on the facility already during design, as well as errors made during the construction of buildings.

4. Preventive activity of construction supervision authorities intending to reduce the number of construction disasters in Poland

On the basis of the results of analyses of construction disasters in Poland, carried out by construction supervision authorities, preventive activities are undertaken to reduce the number of construction disasters, which takes the forms specified in Fig. 3.



Figure 3. Forms of preventive activity of construction supervision authorities intending to reduce the number of construction disasters in Poland (own study)

5. The largest construction disasters in Poland in the post-war period

5.1. List of the largest construction disasters in Poland in the post-war period

The biggest construction disasters occurring in the post-war period in Poland include, in chronological terms:

- A construction disaster during the construction of the building of the Higher School of Agriculture in Wrocław (1966),
- The catastrophe of the Rotunda building in Warsaw (1979),
- The radio mast disaster in Konstanczyn near Gąbin (1991),
- The disaster of the hall in the Gdańsk Shipyard (1994),
- The catastrophe of a multi-family residential building in Gdańsk (1995),
- The disaster of the viaduct under construction in Ogrodzona (2003),
- Construction disaster of the exhibition pavilion at the International Fair in Katowice at Bytkowska Street (2006),
- The catastrophe of the viaduct under construction in the city of Watchmen (2006),
- The disaster of a social building in Kamień Pomorski (2009),
- The disaster of the dam on the Niedów reservoir on the Witka River (07.08.2010),
- The catastrophe of the school building in Kazimierz Dolny (2011).

In the further part of the paper, the general characteristics of the above-mentioned construction disasters are presented.

5.2. General characteristics of the largest construction disasters in Poland

5.2.1. Construction disaster during the construction of the building of the Higher School of Agriculture in Wrocław (1966)

The construction disaster, which occurred on 22.03.1966 during the construction of the building of the Faculty of Land Reclamation for the then Higher School of Agriculture (now the University of Environmental and Life Sciences)

in Wrocław at Grunwaldzki Square was the result of haste and failure to maintain the technological schedule of works. As a result of the pressure of the then political authorities, for whom the propaganda effects of the fact that the "growth" of the building is visible were extremely important, the construction management ordered the workers to erect subsequent elements of the floors without parallel masonry works on individual floors, which would ensure the stiffening of the structure. As a result of the wind in March 1966, the structure collapsed. The construction foreman and nine workers were killed in the crash.

After the disaster, with the help of the army and equipment available at that time, the rubble was dismantled, transporting elements to the rubble dump and trying to reach the buried as soon as possible. None of them survived.



Photo 1. Construction disaster during the construction of the building of the Land Reclamation Department for the Higher School of Agriculture in Wrocław (1966) Source:

https://polskaorg.pl/543475,Wroclaw,1966_Katastrofa_budowlana_na_pl_Grunwaldzkim.html

5.2.2. Construction disaster of the PKO Rotunda building in Warsaw (1979)

15.02.1979 r. o godzinie 12.37, miał miejsce wybuch gazu w Rotundzie PKO w Warszawie. Gmach Rotundy został zniszczony w siedemdziesięciu procentach, wszystkie kondygnacje zapadły się do środka, elementy antresoli spadły na zgromadzonych ludzi, poraniły ich też szyby z olbrzymich okien. W tamtym momencie wewnątrz placówki znajdowało się 170 pracowników i prawie trzystu klientów. W katastrofie uszkodzonych zostało 126 osób (zginęło 49 osób i 77 rannych).

Experts determined that the cause of the drama was a leaky gas installation. It was probably not the fault of man. The winter of 1978/1979 was the winter of the century, low temperatures and ground vibrations caused by trains passing underground (the Rotunda stood, and today - rebuilt and rebuilt - also stands, over the railway tunnel leading from the Central Station to the East) caused the installation to crack, and the thick snow cover meant that the gas did not escape outside, but got into the nearby telecommunications installation, from there to the interior of the building.



Photo 2. Construction disaster of the PKO Rotunda building in Warsaw (1979)
Source: PAP/CAFFoto: A. Urbanek, https://dzieje.pl/sites/default/files/201902/rotunda_0.jpg



Photo 3. Construction disaster of the PKO Rotunda building in Warsaw (1979)
Source: PAP/CAFFoto: M. Kłoś. <https://dzieje.pl/sites/default/files/201902/rotunda2.jpg>

5.2.3. Radio mast disaster in Konstaktyńów near Gąbin (1991)

The radio mast in Konstaktyńów near Gąbin with a height of 646m built in the years (1972-1974) by Mostostal Zabrze - for 17 years (1974-1991) due to its record height was a sensation on a global scale, it was officially entered into the Guinness Book of Records - it was the highest building in the world. The entire mast structure weighed 577 tons and was entirely made of steel. The mast structure is divided into 86 sections, each with a height of 7.5 meters. They had a cross-section in the shape of an equilateral triangle with a side length of 4.8 m. The main supporting elements were made of steel pipes with a diameter of 24 cm. Depending on the place, the walls of the pipes were from 8 to 34 mm thick, they were produced by Huta Batory. The mast was held vertically by 5 lashing units, i.e. a total of 15 ropes with a diameter of 5 cm. Workers entered the mast in a diesel lift; The journey to the top took half an hour.

The mast in Gąbin collapsed on 8.08.1991 during conservation works. The reason was incorrect lashing voltage. Fortunately, no one was hurt during the disaster. The mast broke and fell in such a way that its tip dug into the ground right next to its base. It was planned to rebuild the mast, but the local residents did not agree to it. The successor of the mast was the radio station in Solec Kujawski, whose highest mast is only 335 meters, which is less than half the height of the mast from Gąbin



Photo 4. 646 meter mast in Konstaktyńów near Gąbin after the disaster (8.08.1991)

Source: <https://99percentinvisible.org/article/unheard-catastrophic-collapse-worlds-tallest-tower/>

5.2.4. Gdańsk Shipyard hall disaster (1994)

On 24.11.1994 in the entertainment hall at Jana z Kolna Street in the hall of the Gdańsk Shipyard a musical event was held with the participation of about 2000 people (mainly young people aged 13-20). An hour after the musicians left the stage (around 8:50 p.m.), a fire was noticed on the wooden stand in the depths of the Hall, which very quickly began to spread, the curtain took care of and the fire reached the ceiling. When the lights went out, panic broke out. Everyone rushed to the only known exit from the hall – the main exit, which was not fully open. People fell over each other and were scalded with hot air. 307 people were injured in the incident (7 fatalities and 300 people injured). As a result of the fire, the steel supporting structure of the hall was completely destroyed. It is assumed that the cause of the fire was arson, the perpetrator has not been determined to this day. The organizers of the event sat in the dock, who were accused of not providing unobstructed emergency exits and bypassing the basic rules of fire protection.

According to the prosecutor, the hall did not meet fire safety requirements. Some of the exits were closed and the fire spread so quickly m.in because the stored fiberboard and carpet were taken care of in the wrong place.



Photo 5. Steel structure of the Gdańsk Shipyard hall after the disaster caused by fire (1994 r.), photo. Maciej Kosycarz/KFP

source: <https://historia.trojmiasto.pl/Rocznica-pozaru-hali-Stoczni-Gdanskiej-n107719.html#gallery1photo280175>



Photo 6. Steel structure of the Gdańsk Shipyard hall after the disaster caused by fire (1994 r.), photo. Maciej Kosycarz/KFP

source: <https://historia.trojmiasto.pl/Rocznica-pozaru-hali-Stoczni-Gdanskiej-n107719.html#gallery1photo280175>

5.2.5. Disaster of a multi-family residential building in Gdańsk (1995)

The catastrophe of a single-staircase multi-storey residential building occurred on 17.04.1995 at 5.50 a.m., as a result of a gas explosion. The 3 lower floors collapsed completely (2 floors were driven into the ground). Because the damaged building threatened to collapse at any time, the commission chaired by the Chief Inspector of Building Supervision assessed that the technical condition of the building does not allow for any security works and decided to blow up the remaining part of the building, which was made on 18.04.1995. The rescue operation was carried out only on the rubble. As a result of the disaster, 22 people died, 1 person died suddenly as a result of shock on April 18. In addition, 12 people were injured.



Photo 7. Destroyed multi-family residential building (Gdańsk, 39 Wojska Polskiego Street) as a result of a gas explosion in 1995, Maciej Kosycarz / KFP

Source: <https://www.fakt.pl/wydarzenia/polska/trojmiasto/dzisiaj-mija-20-lat-od-wybuchu-wiezowca-w-gdansk/97c7jc9>

5.2.6. Disaster of the viaduct built on the national road No. 1 in Ogrodzona (2003)

The catastrophe of the viaduct built on the national road No. 1 in Ogrodzona (the viaduct on which the disaster occurred is part of the modernized national road No. 1 to the border crossing with the Czech Republic in Cieszyn-Boguszowice), occurred in the evening of 4.08.2003 – when during the concreting of the viaduct the structure supporting the scaffolding could not withstand the weight of the concrete and collapsed together with the scaffolding on which

there were 25 workers; 16 were injured, of which 11 were taken to hospitals in Bielsko-Biała, Cieszyn, Jastrzębie Zdrój and Piekary Śląskie.

The commission appointed by the Silesian Provincial Inspector of Building Supervision to conduct proceedings to determine the causes and circumstances of the construction disaster determined that errors in the scaffolding design and its implementation are the main reasons for the catastrophe of the above-mentioned viaduct: "the scaffolding suffered a catastrophe already at 65 percent of the normal nominal load, orders to consider the errors made by the scaffolding designer and its contractor as gross".

Members of the committee also raised doubts about the construction rights of persons holding managerial functions on the construction site. In its work, the committee used m.in the expertise developed by Prof. K. Flaga from the Cracow University of Technology. According to the expert, the main reason for the collapse of the scaffolding were mistakes made by the scaffolding designer and contractor. This was confirmed by the scaffolding inspection carried out by the inspector of the National Labor Inspectorate. The expert also pointed out that the organization of work and the way of keeping construction documentation taken over from Western Europe could have contributed to the disaster. "This method is based on the development of appropriate standards, specifications and procedures, the observance of which is to ensure good organization of work and high quality of the product. Unfortunately, it requires documenting every activity on paper, which lulls vigilance and causes engineers to have less and less time to think, fall into routine, become subordinated to a certain bureaucratic machine." – emphasized the Expert.



Photo 8. Disaster of the viaduct built on the national road No. 1 in the village of Ogradzona, 4.08. 2003,
Source: <https://nemu.com.pl/case-studies/zawalenie-sie-konstrukcji-wiaduktu/>

5.2.7. Construction disaster of the exhibition hall at the International Fair in Katowice at Bytkowska Street (2006)

The exhibition hall at 1 Bytkowska Street on the premises of the International Katowice Fair with a steel structure with dimensions in the projection of 97.36x102.875 m and a maximum height of 13.2 m suffered a construction disaster

on 28.01.2006 at 17.15 - during a large mass event. To explain the causes and circumstances of this disaster, the Chief Inspector of Building Supervision appointed a commission, which stated that:

- The direct cause of the ICC hall disaster was the loss of load capacity of trusses and main lattice beams and columns in the central part of the hall, as well as overloading its structure with snow.
- The hall was designed with numerous construction errors, including the load-bearing capacity of the hall structure elements. The construction of the hall did not meet all the requirements of design standards.
- The rapid course of the catastrophe resulted from: defective structural solution of the hall - girders and pole heads; defects in the joints connecting the bundles of the columns with the branches; high strain of many roof elements, such as: purlins, strings, connections between elements; lack of slope and vertical concentrations of the hall roof structure; pseudo-spatial nature of the structure, in which all roof purlins - lattice and beam were connected with each other by braces.
- At the crash site, among m.in negligence in the assembly of the hall structure and excessive strain of the strings were found.
- Already during the construction of the hall and after its failure in 2002, the designer informed the owner of the hall about the need to remove snow from the roof. However, the roof was not cleared of snow with due care.
- The low load capacity of the hall cover was signaled by a failure in January 2002. After such a failure, the entire steel structure of the MTK hall cover should be re-checked computationally, which was not done. The quality of the welds in the main bearing elements was also not checked at that time, despite negative test results.

It is worth emphasizing here that **this is the largest construction disaster in the history of modern Polish**, which led to the harm of about 1300 people, in terms of loss of life (65 people), injury (over 140 people), loss of loved ones, loss of property or psychological damage. The Supreme Court ruled that it is partly the State Treasury that bears civil responsibility for the construction disaster of the MTK hall in Katowice. In addition, the court imposed between 1.5 and 9 years in prison on six of the nine defendants. The highest penalty – 9 years in prison was given to the designer of the hall, 2 years in prison each received: two members of the management board of MTK, a construction appraiser and a building supervision inspector and 1.5 years in prison the technical director of the company.



Photo 9. Construction disaster of the exhibition pavilion at the International Fair in Katowice at 1 Bytkowska Street (2006), Source: General Office of Building Control, Warsaw, May 2006.

5.2.8. Disaster during the construction of the viaduct in Stróža (2006)

The construction disaster during the construction of the viaduct in Stróža (01.07.2006) occurred as a result of the collapse of scaffolding supports under the girders of the steel structure, prepared for merging (photo 10). Before the disaster, several segments were laid on scaffolding. Subsequent segments were attached to each other by connecting the internal longitudinal ribs stiffening the web of the segments on the prestressing screws (Fig. 2). As a result of the disaster, one person died and one was injured. The steel structure of the viaduct built at that time was destroyed, as well as the scaffolding supporting it. The disaster was caused by neglect of many duties, as well as unfavorably from the rights resulting from the Construction Law, m.in the investor's supervision inspector, the designer.

As a result of the work of the National Labour Inspectorate cooperating with the authorities of the Police and Construction Supervision), it turned out that the cause of the construction disaster was non-compliance with the provisions *of the Act - Construction Law* in the field of design solutions and organization of the construction process and compliance with the principles of safety and health protection during construction works, as well as investor's supervision.

The Commission agreed with the assumptions of the technical expertise prepared by Prof. Z. Mendera on the basis of the results of on-site inspections, analysis of the construction project, executive design and organization of the construction. Entries in the construction log and assembly log were also analyzed. The technical report shows that the errors were due, in particular, to:

- careless preparation of the assembly organization project, primarily incorrect estimation of vertical and horizontal mounting loads,
- improperly adopted system of mounting supports, as well as the method of their implementation limiting the displacement of the assembled structure, as well as caused by the difference in daily temperatures,
- careless development of a construction project where:
 - the drawing part was made in the form of sketches, and the calculations were made by hand on loose sheets, without evidence of a strength check by another person,
 - construction drawings of mounting supports were developed by people who did not have the appropriate building licenses,
 - design errors led to further shortcomings, because the loads were underestimated, the system of mounting supports of the PERI type was unfortunately chosen, too flabby, inappropriate for this type of heavy construction, as well as improper use of the road plate and it was not protected against washing out the ground.



Photo 10. General view of the destroyed viaduct structure in Stróža, (according to Prof.PL, M. ŁAGODA, Lublin University of Technology, Road and Bridge Research Institute, Warsaw 2007)

5.2.9. Disaster of a social building in Kamień Pomorski

The catastrophe of the three-storey building of the social hotel in Kamień Pomorski at Wolińska Street - occurred on the night of 12 to 13.04.2009 as a result of a fire outbreak. In the hotel, where 77 people were checked-in, 23 people died in the fire. The fire spread very quickly to all floors of the building, which cut off the evacuation route for residents. According to expert opinions, the fire was started as a result of a short circuit of the electrical installation. It was not possible to determine what was the direct cause of the short circuit. The rapid spread of the fire was influenced by the use of flammable materials in the construction of the hotel.

According to the prosecutor's office, the main irregularities that led to the construction disaster were, m.in, the lack of required inspections and periodic inspections as well as the required expert opinions on the structure of the facility, failure to ensure the limitation of the spread of fire and smoke contrary to the construction law, or failure to ensure the possibility of evacuating people. These obligations resulted from the provisions of m.in on fire protection. By their negligence, a fire was inadvertently caused.



Photo 11. Construction disaster of a three-storey social hotel building in Kamień Pomorski caused by a fire (1995),
Source: <https://www.rmfm24.pl/fakty/polska/news-pozar-w-kamieniu-pomorskim-urzednicy-skazani-na-wiezienie,nld,1678845>

5.2.10. Disaster of the dam on the Niedów reservoir on the Witka River (2010)

On 7.08.2010 there was a construction disaster of the dam on the Niedów reservoir on the Witka River (built in 1962). The catastrophe consisted in the rupture of the dam under the action of a flood wave. Water from the reservoir in the form of a high wave flooded the surrounding towns on the route Bogatynia - Zgorzelec and Zgorzelec itself) - causing disasters of numerous buildings (Fig. 12).



Photo 12 The disaster of the dam on the Niedów reservoir on the Witka River on 7.08.2010

Source: <http://dolnoslaskie.naszemiasto.pl/arttykul/niedow-niedlugo-rozpoczna-sie-prace-budowlane-zapory-z.1329727.art.t.id.tm.html>



Photo 13. Example of a construction disaster caused by the action of a flood wave resulting from the dam disaster on the Niedów reservoir on the Witka Zgorzelec River,

Source: <https://gazetawroclawska.pl/witka-rok-po-powodzi/ga/470836/zd/670858>

5.2.11. Disaster of the building of the Municipal School Complex in Kazimierz Dolny (2011)

As a result of a gas explosion on 31.05.2011 at 6 am (before the start of school classes) on the ground floor of the school building (in the feeding block, in the east wing) three floors with the attic collapsed. In view of the destruction

of the building, damage to part of the roof structure, ceilings, external and internal walls and weakening of the technical condition of the entire structure of the building, the Puławy starost issued a decision on permission for its demolition.



Photo 14. As a result of a gas explosion on the ground floor of the school building (in the food block, in the east wing), the eastern wing was completely destroyed – 31.05.2011 (photo by M. Stachyra)

6. Summary

1. Construction disasters occur in construction processes (investment process and operation process).
2. Disaster events of buildings are directly related to:
 - in particular with their technical condition, primarily in terms of load-bearing capacity of structures and fire protection – generated in the processes of design, construction and operation (i.e. use and maintenance) of buildings;
 - with the environmental conditions of the location of objects;
 - the impact of climatic pressures;
 - adopted construction and material solutions;
 - carrying out construction works in the immediate vicinity of existing buildings, related in particular to the execution of deep excavations.
3. Disasters occurring in the investment construction process result from negligence and mistakes made during the design of the building and during its construction.
4. The analyses carried out show that most construction disasters occur in the process of operation of buildings; Many of these disasters were caused by:
 - uncontrolled destruction of facilities, resulting from negligence in the implementation of statutory obligations by owners and managers of buildings, related to underestimating the threat to objects and therefore failure to control their technical condition and omissions in undertaking maintenance and renovation activities;
 - accelerated degradation, resulting from failure to take into account all factors of destruction or inaccurate assessment of environmental impacts on the facility already during design, as well as errors made during the construction of buildings.

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