Centrum Rzeczoznawstwa Budowlanego

Inżynieria Bezpieczeństwa Obiektów Antropogenicznych 2 (2022) 1-10
https://inzynieriabezpieczenstwa.com.pl/

Inżynieria Bezpieczeństwa Obiektów Antropogenicznych

Exploitation of construction objects in the aspect of the anthropopressure on the example of the Natural Education Centre "Młynarzówka" in the Narew National Park

Jerzy Obolewicz *[1], Adam BARYŁKA[1], and Joao MATOS Da COSTA[2,3]

[1]Scientific Institute of Engineering of The Safety of Anthropogenic Objects, Poland
[2]Narew National Park, Poland
[3]Faculty of Biology, University of Białystok, Poland

Abstract

Since the beginning of its existence mankind is using natural resources and applying them in construction techniques. The anthropogenic pressure induced by humans its clearly influencing the natural environment and so affecting its functional balance. Buildings are anthropogenic objects that enable mankind to inhabit its natural habitat according to their needs.

This article discloses the use issues of buildings according to their anthropogenic pressure taken in consideration the example of a selected building.

Keywords: construction, environment, anthropopressure, exploitation and use of construction objects.

From the beginning of its existence, man has used the natural resources of the environment. This influence intensified in the nineteenth century and led mankind to a new geological epoch, the Anthropocene. Since 1950 (the time of the Great Acceleration), humanity has been able to change the geological, chemical and biological Earth, leaving traces on the Earth's surface that have been permanently embedded in sedimentary records, creating the so-called anthropogenic mass. These changes alter the natural balance of Earth's ecosystems which triggered the mass extinction of species. In the year 2020 the anthropogenic mass outweighed all Earth's living biomass [13, 37, 38, 44].

1 Introduction

According to anthropologists world's population in increasing at 1,1 % per year and will most clearly achieve 9,8 billions by 2050 and 11,2 by 2100. This growth will take place mainly in urban areas and in developing countries [39].

A large share of the anthropogenic mass is building aggregates which are necessary for the construction of buildings. Most probably the consumption of building materials may increase two to four times during the next century. Natural aggregates used in construction such as sand, gravel and crushed rock represent the largest part of the anthropogenic mass and are as well the most extracted solid materials [10]. Construction objects are anthropogenic facilities that meet human needs in terms of housing in their environment. Constructions, structures and small architecture objects are created to meet the various needs of their users, and the way of their construction and operation influences, over the many years of their existence, to a significant extent, the technical condition of the objects, which determines the conditions of safe use and maintenance and affects the environmental burden. nature and the functioning of ecosystems.

To achieve the requirements for the construction of infrastructures it is necessary to know:

- the technical requirements in terms of design, construction, exploitation and maintenance of infrastructures concerning the issues of construction, fire and "safety of use" safeness;

*corresponding author: E-mail address: (obolewiczjerzy@gmail.com) Jerzy OBOLEWICZ

https://dx.doi.org/10.37105/iboa.135
Received 24 May 2022
Available online 30 June 2022
2450-1859, eISSN 2450-8721
Published by Centrum Rzeczoznawstwa Budowlanego

- basic information related to the necessity and techniques to monitor their safeness considering control activities carried out by state authorities during construction, which highlight the problems with moisture, wintertime facilities maintenance, removal of asbestos, thermal modernization, corrosion, unauthorized construction, changes in buildings exploitation or greenspaces maintenance to which it is possible to signal their essence and propose methods for a proper implementation;
- the role of the technical building conditions periodical inspections, which are the preliminary stage of diagnosis, thanks to which it is possible to prevent breakdowns or building disasters;
- the basic procedures of the evaluation elements for assessing the conditions of buildings construction;
- definition and classification of construction works undertaken by the owners and managers of infrastructures, highlighting the requirements of the construction law;
- obligations and rights of all the people which are involved in the investment and in the construction process;
- the violation issues of the construction law during the exploitation period, including the legal problems liability when improperly used;
- the anthropopressure issues caused by the exploitation of infrastructures and their influence and contamination of the natural environmental ecosystems [32–34].

2 Technical requirements for the design, construction, use and maintenance of construction objects

Statute – the construction law regulates the activities related to the design/project, construction, maintenance and demolition of infrastructures and set up the rules of the public administration activities in these areas. According to the construction law, infrastructures/ buildings are supposed to be “used” in agreement with their intended purpose and environmental protection requirements and “maintained” in a proper technical and aesthetic condition, not allowing excessive deterioration of its functional properties and technical efficiency [41].

The owner or the manager are obliged by the legislator to control:

- periodically, at least once per year, to check the technical conditions:

- elementów budynku, budowli i instalacji narażonych na szkodliwe wpływy atmosferyczne i niszczące działania czynników występujących podczas użytkowania obiektu;
- of the construction elements, structures and installations exposed to harmful weather conditions and damaging factors which occur throughout its exploitation;
- of the installations and equipment destinated to environmental protection;
- of the gas installations and chimney ducts (smoke, exhaust gas and ventilation);

- periodically, at least every 5 years, the technical conditions and suitability for the exploitation of the building, the aesthetics of the building and its surroundings; this inspection should also test the electrical and lightning protection of the installations in terms of efficiency connections efficiency, fixtures, protections and means of protection against electric shock, resistance of wire insulation and grounding installations and equipment;

- periodically, at least twice a year, between 31 May and 30 November, in the case of buildings with a built-up area exceeding 2000 m2 or buildings with a roof area exceeding 1000 m2; the person performing this inspection is immediately obliged to notify by text the building supervisor authority about the performed inspection;

- the safe use of the construction object any time unforeseen circumstances arise [41].

The legislator did not define the terms “use of an construction object”, “maintenance of the building object” neither the concepts of technical state nor aesthetic conditions. To define the terms “use” and “maintenance” of construction objects it is necessary to recur to the jurisprudence of court sentences.

The jurisprudence of the administrative courts accepts that the "use of a construction object" should be considered, in the sense of common language, as the use or benefit of it. The notion of commencement of use should be understood as the occurrence of a specific factual state, consisting in the commencement of use of a facility or its part. Even a short-term commencement of use its sufficient for the assumption of the fact of commencement of use. It is rightly

considered that commencement of use its a one-time action. The commencement of use may be effected only once; subsequent use is to be regarded as continued use. By "maintenance of construction objects" is it meant maintenance in good efficiency order, preservation in an unchanged, undeteriorated proper condition, while the inadequate technical condition of an infrastructure is usually the result of technical wear of the infrastructure or due to sudden events occurring after it was put into use [45]. Both "use" and "maintenance" of a construction object require technical, organizational, economic and social actions that allow to maintain the exploitation potential throughout its life. Lack of exploitation knowledge causes negative economic consequences, therefore knowledge in the field of "exploitation engineering", the so-called " exploitation" [27] and being able to transfer it to the infrastructure's area becomes an urgent issue.

[15, 43]

2.1 The operational condition of the building object

In the literature, the condition concept of an operational facility is usually identified with its "technical" and "aesthetic" meanings, referring to certain properties of the facility [36]. According to Prof. Kasprowicz, the operational state of an infrastructure its influenced by the features that describe the possibilities and conditions of using a given construction object in accordance with its current purpose, as well as the possibilities and conditions of maintaining its usable capacity over a specified period of time [22].

Exploitation characteristics are quantitative and qualitative parameters determined based on technical, technological, functional, organizational, economic, systematic and aesthetic characteristics measured on the construction object, pointed out by experts or calculated based on the characteristics measured or determined by experts, which describe the significant properties of the facility from the exploitation point of view.

Specific requirements of the exploitation characteristics:

- the exploitation characteristics should be measurable, determinable or calculable,
- the size and structure of the exploitation characteristics set should be adequate and sufficient to describe the exploitation state of construction object and directly dependent on the type of functions performed; it is a set of individual characteristics for each construction object, containing only the necessary features to describe its exploitation state;
- the set of the exploitation characteristics should describe the exploitation state of an construction object allowing to measure and comprehensively describe its exploitation state from the point of view of its required functions and ensuring the possibility to their fulfillment [4].

A diagram of the exploitation state of a building is shown in Fig.1.

The identified exploitation characteristics/factors (Fig.1) are placed in different subsets:

- "exploitation" describes the possibilities and conditions for using a facility according to its current purpose,
- "maintenance" which describe the capabilities and conditions to preserve or restore a facility's ability to be used for its current purpose.

In practice, it is possible to encounter the following cases: good technical condition and good aesthetic condition, good technical condition and poor aesthetic condition, poor technical condition and good aesthetic condition, or poor technical condition and poor aesthetic condition. By the analysis of the exploitation course of an object it is possible to distinguish:

- the initial state, in which both the technical and aesthetic state are described as good, i.e., state in which the technical, aesthetic and economic parameters are perceived as new for the object;
- the state of use, beyond which the object should be subjected to preventive maintenance, or otherwise, a deterioration considered to be unfavorable will occur in the technical and aesthetic parameters;
- threshold state, certain parameters have reached values considered to be unacceptable for the technical, aesthetic, functional and/or economic reasons; when exceeded, the facility ceases to be used either because it is no longer physically possible to be operational or as a result of a decision to take it out of service [5].

Technical condition of the construction object

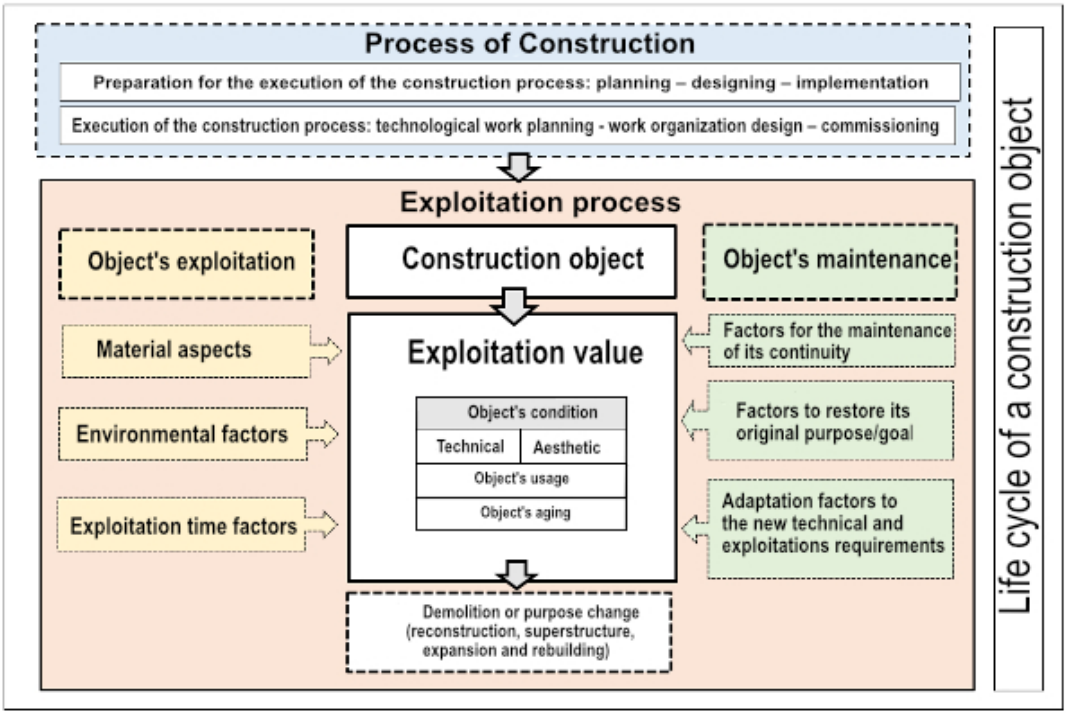

Figure 1. Scheme of the operational condition of a construction object

The term "technique" in practice has two meanings. from one side, "technique" is the knowledge about a practical use of scientific achievements together with their application, and on the other side, is a way or method, considered as a learned and trained skill to perform a specific action. Knowledge is a set of reliable information about a specific subject.

In construction the term "technical condition" defines the condition of a construction object and directly refers to its reliability and durability throughout use and indirectly to the different stages of the construction process: planning, design and building (object execution). The quality of the technical condition of a construction object is determined by economic considerations taken into account throughout its life cycle by the costs incurred in the construction area in which the facility is built as well as by the operating costs generated during its exploitation. For example, increasing construction costs (better materials and technology) reduces long-term operating costs, while reducing construction costs (inferior materials and technology) increases long-term operating costs [3]. While projecting construction objects solutions that minimize the total construction and exploitation costs should be adopted. However, normally only solutions that minimize construction costs are used.

Design solutions for the roof structure of a construction object can be taken as an excellent example. Three solutions may be analyzed here. In the first one, the designer minimizes investment costs by designing a cheaper roof structure, which will not be able to sustain the above-normal snow load and so it will increase exploitation costs related to the necessity to take the snow from the building roof. In the second case, a more robust (more expensive) structure is designed which will be able to sustain the above-normal snow load and so it will not be required any exploitation extra costs to take the snow from the roof. The most appropriate seems to be the third option, a mixed solution. The designer projects a cheaper structure, which, despite the fact that it will not be able to sustain an above-normal snow load, is selected under the condition of introducing an automatic snow removal system, using modern methods able to melt the snow and the ice, or a system to monitor the structure's condition, capable to signal a snow load risk, and so it will be possible to remove the snow from the roof in an appropriate time.

Aesthetic condition of the construction object

"Aesthetics" - in the common sense, is the science of beauty which deals with the study of artistic values and aesthetic judgments, investigating the causes of their formation and determining the criteria of these values and judgments. In the field of construction, the object of artistic research and aesthetic judgments is a construction object. The "aesthetic condition" of a construction object can be defined as a condition that corresponds to the

requirements of aesthetics, related to the senses of beauty and taste, to which characteristics such as quality, shape, character, or level have been attributed [4].

The condition of a construction object can be classified and described as good, bad or transient. There are several terms used in court decisions to define the aesthetic condition of a building, for example, adequate aesthetic condition is a state in which the facade, appearance and other elements are in good condition and so they ensure harmony between the appearance of the building in the natural and artificial environment. If a construction object causes defacement in the environment, its aesthetic appearance will be considered poor or at least inadequate.

2.2 Changing process of a construction object's condition

The influence of several external and internal factors (interactions) in the aging and wear processes, as times passes the conditions of a construction object change as well as its durability. The durability of construction elements is shown in (Fig. 2).

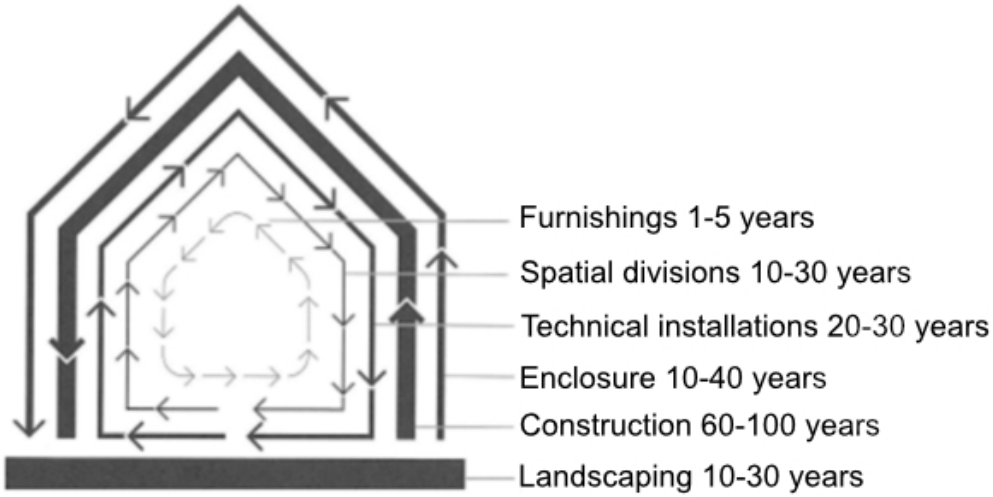

Figure 2. Durability of construction elements

Knowing the essence of how a construction object's condition change is essential to solve most of the design, construction, manufacture and exploitation issues, because aging and wear processes of construction object are inherent to their existence and so information about the wearing issues of a construction object becomes essential to maintain a proper exploitation of a infrastructure, a building or a small architectural object [2–4].

Wear of a construction object

The wear of a construction object is a set of changes in its technical condition, in its individual components, with respect to materials and construction, under the influence of the factors of the aging and wear process of an object [4]. The consumption processes of a construction object depend on external and internal conditions (tab.1). Environmental conditions (external and internal) can cause immediate threats (tab. 2), and therefore threats can take various forms (tab. 3.).

Technical wear of a construction object

The definition of the technical condition of a construction object is necessary for the owner/ manager to determine if the building is being held in a good technical and aesthetic conditions. This activity allows the identification of the causes that may cause damage or destruction [4].

The most common causes that affect the technical conditions of a construction object, those that cause damages, are described in Table 4.

Social/immaterial consumption of a construction object

Table 1. Environmental factors and impacts

Nr.	Group of factors	Factors
1	External	Environmental factors: humidity, pressure, temperature, wind, atmospheric pollution, water and soil. Problems associated with the facilities located in the surrounding area. Problems associated with construction activities around the site.
2	Internal	Mechanical, physical and chemical factors associated with the operation of the facility determined by how it is used and maintained. Construction processes at the facility throughout its exploitation period. Random events such as fires, explosions and etc.

Table 2. Types of hazards in the building

Nr.	Group of hazards	Environmental factors
1	External risks from the surroundings of the construction site	Highways and freeways. Industrial facilities. Tram and railway lines. Waterways. Surface and underground mines (mining damage). Lack of light or intense sunlight. Construction works in the immediate vicinity.
2	Random hazards	Natural source Hazards (earthquakes, floods, fires, high winds or avalanches). Anthropogenic threats (mechanical impacts, armed conflicts)
3	Ecological internal threats	Noise, vibration, shocks. Radiation from groundwater. Aggressive odors and fumes. Biological pests (molds, fungi, insects, rodents or other animals).

Table 3. Forms of wearing out a building.

Nr.	Group name	Types of consumption	Type of impact
1	Material consumption, (physical), Technical wear	Normal consumption	Influence of weather conditions. Influence of atmospheric factors. Internal influence factors in the work environment.
		Accelerated consumption	Design/project errors. Labor errors. Incorrect use. Incorrect maintenance.
		Sudden consumption	Malfunctions. Random causes (floods, storms).
2	Social/immaterial wear	Moral consumption	Increased demands due to the rise of life standards. Lifestyle changes.
		Functional consumption	Intentional or random alteration of an object's functions.
		Technological consumption	Improving the performance of new concepts.
3	Economical wear	Increase of the expenses	Reduced economical efficiency.

Social wear is considered as an immaterial consumption, understood as moral, functional and technological aging of an existing construction object as a result of technological progress, which reduces its usefulness and, in extreme

Table 4. Causes that affect the technical conditions of a construction object

Nr.	Group	Description
1.	Technical consumption of the materials	Construction object component Materials
2.	Wear caused by external environmental factors	External environmental factors can cause erosion and corrosion of the building materials, make the foundations wet, soak the foundations, compact the soil, freeze the structure, cause vibrations and shocks, chemically contaminate, and allow the action of biological agents.
3.	Factors associated with uneven settlement or cracking of the soil beneath the foundation	Problems caused by nearby earthworks or by changing the amount of water in the ground due to a lowering of the water table or by waterlogging the ground as a result of a flood.
4.	Factors caused by chemical (atmospheric) and biological corrosion	Problems that occur in the structural elements.
5.	Vibrations	Problems caused by the movement of machinery, vehicles, or by the work performed in the vicinity of the facility.
6.	Unforeseen activities	Impacts from vehicles, cranes, rising of the groundwater or of a natural reservoir, natural disasters (floods, hurricanes), rock mass movements caused by mining damage, earthquakes, fires caused by accumulation of flammable materials in the facility.

cases, the inadequacy of the existing material, technological and functional solutions. Social exploitation can take the form of moral, functional or technological wear [4].

Moral wear should be understood as the inability of a construction object to meet its functional utility requirements due to changing trends, fashions or for economic reasons, for example, high costs to adapt it to the user needs and the inability to acquire benefits, for example, from renting the object.

Functional wear is the deterioration of the functional characteristics when compared to objects with a similar function occurring in the market under review, caused by non-compliance with current user requirements, standards or technical conditions.

Typical factors that cause functional wear:

- change the function of the building or change of user,
- architectural and spatial solutions,
- construction standards,
- transport accessibility,
- comfort of use,
- exploitation conditions.

The degree of functional wear, in practice, is determined by the percentage of the factors above mentioned. Technological wear is observed when better performances to the operation of the building are available.

Economical wear of a construction object

Economic wear occurs when it is more expensive to keep a construction object in operation than other newer buildings with the same purpose. The measure of the technical wear of a building is the degree of its weariness, which is expressed in terms of percentage. The degree of weariness is the basic indicator of the market or replacement value of a building.

The technical condition and degree of weariness of a construction object are among the most important factors influencing the value of the building under evaluation, especially when it is being used the replacement cost method. The need to use a technical state assessment method in the context of its practical application and the needs arising from the purpose for which the assessment is carried out and the state the object to be assessed is in should be considered independently [1, 6, 8, 9, 19, 23, 25, 26, 31].

3 Anthropopression caused by the exploitation of construction object's

According to the Article of the Environmental Protection Law, the term environment - is defined as all the natural elements, including those that have been transformed as a result of human activity in particular, the land surface, mines, water, air, landscape, climate and all other elements that maintain biodiversity, as well as the mutual interactions between these elements [40]. The environment is the natural habitat of every society.

Human beings live in and exploit the environment under specific conditions, use its resources, individually transform each of its elements as well as they introduce new components - products of their own exploitation, for example buildings. Considering the degree of man-made transformation in the environment (anthropoppression), it can be distinguished:

- natural environment (unmodified) its considered the set of natural elements that occur in a given area. It is assumed that we deal with the natural environment when the degree of transformation of its elements by man does not exceed a certain percentage. Currently on Earth, such areas are the circumpolar regions, deserts, high mountains and the lower parts of the ocean floor;
- geographic environment (transformed), understood as a set of natural elements or man-made elements transformed by more than 50% , i.e. roads, industrial, agricultural and transport infrastructure;
- anthropogenic environment (artificial), is the geographical environment saturated with manmade objects, by about 90%, e.g. urban and industrial areas [4].

The term "anthropopressure" should be understood as all human activities that affect the natural environment, resulting from the use of natural resources to meet our own needs [21].

The effect of human impact in the environment its an increase in its loading and contamination. These impacts can take direct and indirect forms.

Direct impacts cause immediate effects and permanent changes as a result of, for example, construction and soil movement works, or due to incorrect exploitation of the facility. Indirect impacts are caused by a specific environmental element, which carries the hazard from its source to the affected area, e.g. destruction of plants (trees), air, water or soil pollution. Direct and indirect impacts cause changes in land use and are considered the main drivers of biodiversity loss.

Changing sensory stimuli affects almost all organisms, which use sensory information to interpret and interact with the environment. Urbanization and population growth have led to a rapid increase in artificial lighting. Artificial Light at Night (ALAN) affects almost all habitats, with 22.5% of the entire globe and nearly 88% of the European land area experiencing an increase of 8% in night sky brightness above the natural levels. ALAN is increasing at a rate of 2-6% per year worldwide and it is known to affect humans and animals, especially crepuscular and nocturnal species [7, 11, 12, 16, 28]. Almost all living organisms have evolved with a natural rhythm of day and night, and 30% of vertebrates and 60% of invertebrates are nocturnal. Species that are less attracted to artificial light sources are likely to thrive through the process of natural selection. It has been suggested that ALAN affects the behavior of several insect orders (for example, moths - Lepidoptera and beetles - Coleoptera) and it is known that insects are an essential component of the ecosystems and that their abundance and diversity are in rapid decline [12, 14, 17, 18, 24, 42]. It is possible to adjust the spectral composition of lights to minimize the attractiveness of nocturnal arthropods. Several studies continue to show that different lamps with different light spectra show differences in insect attraction, so street lights and outdoor lamps should be selected to reduce the impact on biodiversity loss [14, 24, 29, 30, 42]. The climate changes that are part of the Anthropocene are already causing significant stress to life on Earth. Both flora and fauna are being affected with these changes [35]. Changes in habitats are also causing forced migration of people, which may result in an upcoming refugee migration [20].

4 Conclusions

There is a demand to adapt the structures that are construction object's in the Anthropocene and to establish priorities that will enhance and facilitate the important environmental and cultural changes that humanity faces. This may include new design methods, the necessity to a better use of the environment without having to invest energy and materials in new anthropogenic facilities.

Anthropogenic construction objects should be simplified to a degree of complexity that gives the confidence that they will be used and maintained in accordance with the ecosystem requirements. The construction industry in its broadest sense, and within it construction object's throughout their life cycle, must adapt to the state of the Anthropocene. This is a task for investors, designers, contractors, and construction object's users.

References

1. Bakalarz, A. Ocena okresu użytkowania elementów i obiektów budowlanych do celów projektowych. *Zeszyty naukowe Politechniki Śląskiej* **95** (2002).
2. Baryłka, A. *Okresowe kontrole obiektów budowlanych w procesie ich eksploatacji* (Wyd. Centrum Rzeczoznawstwa Budowlanego, Warszawa, 2018).
3. Baryłka, A. *Poradnik rzeczoznawcy budowanego tom.1. Problemy techniczno-prawne diagnostyki obiektów budowlanych* (Wyd. Centrum Rzeczoznawstwa Budowlanego, 2018).
4. Baryłka, A. *Poradnik eksploatacji obiektów budowlanych* (Wyd. Centrum Rzeczoznawstwa Budowlanego, Warszawa, 2020).
5. Baryłka, A. & Baryłka, J. *Proces eksploatacyjny obiektów budowlanych – Poradnik dla właścicieli i zarządców nieruchomości* (Wyd. Centrum Rzeczoznawstwa Budowlanego, Warszawa, 2016).
6. Bucoń, R. *Model decyzyjny wyboru wariantów remontu lub przebudowy budynków* (Politechnika Lubelska, 2017).
7. Delhey, K. & Peters, A. Conservation implications of anthropogenic impacts on visual communication and camouflage. *Conserv.Biol* **31,** 30–39 (2017).
8. Drozd, W. Metody oceny stanu technicznego budynków w aspekcie ich praktycznego zastosowania. *Przegląd budowlany* **4** (2017).
9. Dębowski, J. *Problematyka określania stopnia zużycia technicznego budynków wielkopłytowych* (Wydawnistow Politechniki Krakowskiej, 2007).
10. Elhacham, E., Ben-Uri, L. & Grozovski, J. e. a. Global human-made mass exceeds all living biomass. *Nature* **588,** 442–444 (7838 2020).
11. Falchi, F. *et al.* The new world atlas of artificial night sky brightness. *Sci Adv* **2** (2016).
12. Firebaugh A.and Haynes, K. Light pollution may create demographic traps for nocturnal insects. *Basic Appl. Ecol* **34,** 118–125 (2019).
13. Folke C.and Polasky, S. R. J. G. V. & Westley F.and Lamont, M. Our Future in the Anthropocene Biosphere. *Ambio* **50,** 834–869 (2021).
14. Foster, J. *et al.* Light pollution forces a change in dung beetle orientation behavior. *Curr. Biol* **31,** 3935–3942 (2021).
15. *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences* (OECD Publishing).
16. Halfwerk, W. & Slabbekoorn, H. *Pollution going multimodal: thecomplex impact of the human-altered sensory environment on animalperception and performance* (2015).
17. Hallmann, C. *et al.* More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLoS ONE* **12** (2017).
18. Holker, F., Wolter, C., Perkin, E. & Tockner, K. Light Pollution as a Biodiversity Threat. *Trends Ecol. Evol* **25,** 681–682 (2010).
19. Hopfer, A., Krawczyk, M., Źróbek, R. & Źróbek, S. *Szacowanie nieruchomości zurbanizowanych, Część. I* (Meritum, Warszawa, 1993).
20. *Human tide: the real migration crisis* `http://reliefweb.int/sites/reliefweb`.
21. Janikowski, R. *Zarządzanie antropopresją* (Difin, Warszawa, 2004).
22. Kasprowicz, T. Podstawowe problemy i zakres badań inżynierii przedsięwzięć budowlanych. *Inżynieria Morska i Geotechnika* **5** (2013).
23. Knyziak, P. *Propozycja nowej metody określania zużycia technicznego budynków* (Wydawnictwo Politechniki Białostockiej, 2008).

24. Komatsu, M. *et al.* Managment of flying insect on the expressways through an academic-industrial collaboration: evaluation of the effect of light wavelengths and meteorological factors on insect attraction. *Zoological Letters,* 1–15 (2020).
25. Krajewska, M. Określanie stopnia zużycia technicznego obiektów dla okresów wcześniejszych Akademia Techniczno – Rolnicza w Bydgoszczy, zeszyt naukowy Nr 205. *Budownictwo* (29 1997).
26. Kłopociński, W. *Wycena nieruchomości miejskich, Stowarzyszenie Geodetów Polskich, 1995 Wycena budynków* (WACETOB, 1995).
27. Legutko, S. *Podstawy eksploatacji maszyn i urządzeń* 11–12 (Wydawnictwa Szkolne i Pedagogiczne, 2020).
28. Lim, M., Sodhi, N. & Endler, J. Conservation with sense. *Science* **319** (281 2008).
29. Matos da Costa, J. Preliminary studies toward an effective Macrolepidoptera Monitoring system in the forests of the Narew National Park, North-east Poland – ultraviolet vs actinic light Heath traps. *World Scientific News* **99,** 193–214 (2018).
30. Matos da Costa, J. Changes in the power (Watts) of the actinic light do not affect its better performance vs the ultraviolet light. *World Scientific News* **157,** 154–168 (2021).
31. Michalik, K. *Zużycie techniczne budynków i budowli. Metodologia oceny stanu technicznego budynków i budowli* (Wydawnictwo Prawo i budownictwo, 2014).
32. Obolewicz, J. *Demoskopia bezpieczeństwa i ochrony zdrowia przedsięwzięć budowlanych* (Oficyna Wydawnicza Politechniki Białostockiej, Białystok, 2018).
33. Obolewicz, J. *Poradnik inżynierii bezpieczeństwa pracy przedsięwzięć budowlanych* (Oficyna Wydawnicza CRB, Warszawa, 2021).
34. Obolewicz, J., Baryłka, A., Jaros, H. & Ginda, G. A map of knowledge and its importance in the life cycle of a constructiom object. *Inżynieria Bezpieczeństwa Obiektów Antropogenicznych* **2** (2020).
35. Parmesan, C. & da Costa, Y. M. A globally coherent fingerprint of climate change impacts across natural systems. *Nature* **421,** 37–42 (2020).
36. Sowa, A. Stan obiektu jako wieloznaczne pojęcie we współczesnej eksploatacji technicznej. *Mechanika.Czasopismo techniczne* **7** (2012).
37. Torres, A. *et al.* Sustainability of the global sand system in the Anthropocene. *One Earth* **4,** 639–650 (5 2021).
38. Turney, C. *et al.* Global peak in atmospheric radiocarbon provides apotential definition for the onset of the Anthropocene Epoch in 1965. *Scientific Reports* **8,** 3293 (2018).
39. *United Nations, Department of Economic and Social Affairs, Population Division (2017). World Population Prospects: The 2017 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP/248* 2017.
40. *Ustawa z dnia 27.04.2001 Prawo ochrony środowiska*
41. *Ustawa z dnia 7 lipca 1994 r. Prawo budowlane*
42. Van Langevelde, F., Ettema, J., Donners, M., WallisDeVries, M. & Groenendijk, D. Effect of spectral composition of artificial light on the attraction of moths. *Biol. Conserv* **144,** 2274–2281 (2011).
43. Van Langevelde, F., Grunsven, R., Veenendaal, E. & Fijen, T. Artificial lightining inhibits feeding in moths. *Biology Letters* **13** (3 2017).
44. Waters, C. N. *et al.* The Anthropocene is functionally and stratigraphically distinct from the Holocene. *Science* **351** (2016).
45. *Wyrok Naczelnego Sądu Administracyjnego w Warszawie z dnia 15 marca 2017 r., II OSK 2073/15 LEX nr 2271782*