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Research paper

The influence of maintaining proper technical condition on the aging of multi-family residential buildings constructed in traditional technology

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Abstract: The paper analyses 100 multi-family residential buildings with basements made in traditional technology, with a usable area from 604.50 m^2 to 2315.00 m^2, built between 1952 and 1958 in the Masovian Voivodship. For the analysed buildings, individual elements were inspected once a year and their technical condition was determined. The research was conducted in 2018–2022 and focused on three selected buildings. The results of the study carried out by the authors were used to determine the degree of their aging using the visual method and to compare the results with those obtained from computational methods, e.g., time methods: linear, non-linear, parabolic. The main emphasis in the article is on faulty repairs of buildings, often without proper supervision and the impact of this phenomenon on the accelerated aging of buildings. Although the faulty repairs are common, they are omitted in the methods of predicting the aging of buildings. The paper also presents the analysis of the repair management carried out on the basis of post-inspection recommendations. The results of the conducted analysis confirm that the visual method is the most accurate to determine the degree of wear and tear of the building due to the possibility to determine its actual condition, considering account of the renovations carried out and their quality. The value of the degree of technical wear of selected buildings S_z was similar for visual and time methods.

Keywords: technical condition of the building, multi-family residential building, aging of the building, traditional technology, building damage

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1. Introduction

The proper maintenance of technical condition of multi-family residential buildings is one of the key factors determining their aging process. According to Art. 61 of the Construction Law Act [1] R, the owner or manager of a building facility is obliged to maintain and use the facility in accordance with its intended purpose and environmental protection requirements, and to maintain it in a proper technical and aesthetic condition, preventing excessive deterioration of its functional properties and technical efficiency, and to ensure safe use of the facility in the event of external factors affecting the facility, related to human activity or natural forces. According to Art. 62 of the Construction Law [1] and the Regulation of the Minister of the Interior and Administration of 16 August 1999, on technical conditions for the use of residential buildings [2], the owner or manager of a building is obliged to periodically inspect buildings at least once a year by authorized persons to diagnose faults. According to this Regulation [2], inspection reports should be the basis for drawing up a list of renovation works of buildings. Meanwhile, the reality shows that not all buildings are subject to regular periodic inspections, and necessary and proper repairs during their use, which leads to a reduction in the functional properties of their individual components and the acceleration of the aging process.

During the process of using buildings, especially those not subjected to regular, periodic inspections, it is useful to forecast their aging process. According to the standard [3], predicting the degradation of a building should consist in forecasting changes in performance properties over time. For this purpose, in accordance with the standards [3–5], procedures related to the expected period of use of buildings and an aging program should be developed, taking into account the most important degradation mechanisms.

The prognosis of the aging process of the building is necessary when making decisions about the renovation of building elements [6–8]. According to the standard [3], the prediction of building degradation should consist in forecasting changes in performance properties over time, and function representing performance properties – time, should be developed. When planning renovation works, in addition to the repair or replacement of the necessary elements of the building, possible changes resulting from the constantly growing civilization needs of the inhabitants should also be considered [9, 10]. In scientific research, attempts are made to describe the process of degradation of residential buildings as a whole or individual elements using, among others, neural networks, fuzzy logic, stochastic processes and calculations of the technical condition using the time method (linear, non-linear and parabolic methods) [11–26]. The simplest and most frequently used are time methods. The linear method is most often used for poorly maintained buildings, i.e., for buildings characterized by a lack of renovation or sporadic renovations. The non-linear method is used for buildings that are normally maintained, i.e., regularly renovated. The parabolic method is used for buildings that are carefully maintained, i.e., renovated more often than normal.

Compared to all methods for assessing the condition of building elements, the method of visual assessment is most often practiced, based on external inspection of elements in connection with the age of durability and operation of the building. This relatively fast method gives generally accepted results, even though it is based on arbitrary estimates. The visual inspection, if necessary, can be supplemented by making excavations in representative places or indicative of damage, and if necessary, refer to laboratory tests on samples taken from the building. In the case of the visual method, the assessment of the technical condition takes into account the actual damage to elements resulting, for instance, from incorrect repairs or vandalism. An inventory of damage to such parts of the building as: facades, roofs, basements, staircases and corridors, combined with an interview conducted with the facility manager, allows to determine its value in a sufficient way. The registration of damages revealed in apartments reported by residents and the list of repair interventions undertaken by administrators may provide sufficient information on the condition of inaccessible elements [27].

In addition to the visual assessment, the weighted average degree of technical wear of the building, usually expressed as a percentage, is also used. By using this parameter, the share of the degree of destruction of individual elements in the weighted degree of destruction of the building can be considered in the estimation. These calculations, however, give only an approximate value of the degree of wear due to the determination of the components contained in the formula, which is at the discretion of the appraiser. The nature of the weighted values eliminates some large deviations, i.e., if the appraiser underestimates or overestimates the degree of wear of individual elements, the result will not be disturbed too much. The inaccuracy will increase in case of an incorrect valuation of the degree of wear of the elements with a significant share in the cost of the entire facility. However, if a mistake is made in estimating the consumption of both cheap and more expensive structural elements, the formula will not correct anything and the whole will be calculated with a large error. Therefore, it is worth to carefully determine the degree of wear of expensive elements, that is those with a high share in the cost of the building. Thus, this method requires expertise and is also quite time-consuming [28].

In addition to the basic parameters used to describe the building aging process, such as expected period of use, durability and age, the following problems of maintaining the facility should also be considered:

– errors in design and/or during construction process,
– performing repair works in an incorrect or temporary manner,
– errors at the planning stage of renovation works,
– damage resulting from lack of knowledge/experience of the building's manager,
– intentional damage (vandalism).

These factors often lead to the acceleration of the aging process of the building or its individual elements and are omitted in the descriptions of aging processes.

Considering the above, it can be concluded that the correct development of the scope and program of renovation in buildings requires diagnostics of the technical condition. Only a correct diagnosis allows to accurately determine the condition of the building, the causes of damage and the forecast of unfavourable changes that will help to determine repair needs [29–31].

The paper deals with the technical condition of selected multi-family residential buildings with basements, made in traditional technology. The article identifies the factors influencing the degradation of the analysed buildings, which are divided into: factors of natural origin, factors operating inside the building – caused by usage or being a consequence of design or execution errors, factors resulting from the lack of appropriate knowledge of people managing the building, factors caused by human activity (vandalism). For the selected buildings, the degree of technical wear and tear was determined on the basis of visual inspection and three time methods: linear, non-linear and parabolic. The research hypothesis presented in this paper state that the visual method is the most accurate to determine the degree of wear and tear of a building. Due to the insufficient accuracy of existing methods for predicting the aging of buildings, further research should be conducted to improve the results obtained closer to the real situation. The results of our work may be helpful in forecasting changes in the functional properties of residential buildings and could be used by the owner or manager of a building to support the results of periodic inspection of buildings.

2. The analysed buildings

The study analyses 100 multi-family residential buildings with a basement made in traditional technology, with a usable area from 604.50 m^2 to 2315.00 m^2, built in the years 1952–1958 in Warsaw. The buildings consist of 4 floors above ground and 1 underground. For the analysed buildings, individual elements were inspected once a year and their technical condition was determined. The research was conducted in 2018–2022.

On the basis of the analyses carried out on 100 multi-family residential buildings, it was found that only in 6 buildings proper renovation management was carried out and renovation works were carried out in accordance with the recommendations resulting from the annual periodic inspection. No renovation was carried out in 58 buildings resulting from post-inspection recommendations during the 5-year analyses. In 11 buildings, repairs were carried out in a defective manner, which contributed to an increase in the degree of wear and tear of the building. In 1 building, defective works were carried out at the request of the Management Board, consisting in the installation of gutters, which contributed to the degradation of the roofing and flashings of the roof.

From the analysed buildings, three characteristic ones were selected: a building with properly conducted renovation management (Building no. I), building with defects resulting from the manager's lack of knowledge/experience (Building no. II), building with only necessary repairs carried out (Building no. III). The characteristic parameters of the three selected buildings are presented in Table 1.

In the case of building no. 1, the renovation works were performed properly, under the supervision of an authorized and experienced person in construction works. The building is in good technical condition, and its visual assessment did not show any defects requiring urgent repair. In the case of building no. 2, renovation works were carried out without the supervision of authorized persons represented by the investor. The visual assessment of that building showed many defects resulting from improper execution of renovation works. The defects that appeared after the completion of renovation works on the roof and façade are shown in Fig. 1–4. In the case of building no. 3, only necessary repairs were made to ensure its continued use.

Fig. 1. Steel flashing of the attic at the chimney made in a way that prevents water from flowing out. There was moisture on the façade below

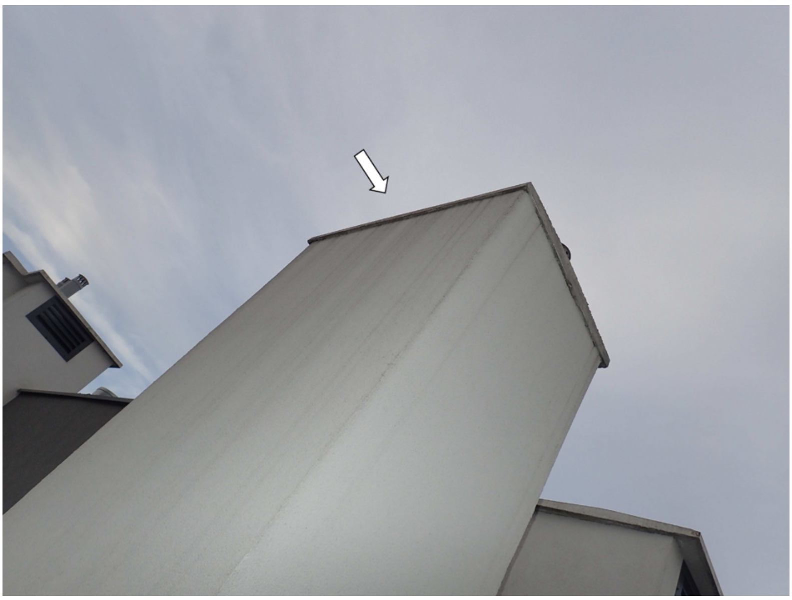

Fig. 2. Chimney caps with too small a drip causing stains on the chimney shaft

Fig. 3. The chimney cap is made of two prefabricated concrete slabs. Plates are not connected to each other, which let water inside the chimney

Fig. 4. Corroded steel beams of the balcony slab covered with a finishing layer without their renovation or anti-corrosion protection and without proper waterproofing of the slab

Table 1. Characteristic parameters of the three selected buildings

Building no.	**Year of construction**	**Usable area [m^2]**	**Renovations carried out in the building**
I	1954	1,820.35	– foundation insulation – replacement of the façade with a thin-layer one together with polystyrene thermal insulation – repair of chimneys – replacement of roofing with thermal insulation – PVC window replacement – aluminium entrance doors replacement – equipping the building with central heating – equipping the building with hot water – execution of vertical insulation of foundations – renovation of staircases – current repairs of cold water and sewage systems
II	1959	1,954.80	– foundation insulation – replacement of the façade with a thin-layer together with polystyrene thermal insulation – repair of chimneys – replacement of roofing with thermal insulation – PVC window replacement – aluminium entrance doors replacement – equipping the building with central heating – equipping the building with hot water – execution of vertical insulation of foundations – renovation of staircases – current repairs of cold water and sewage systems
III	1952	1,476.90	– repair of chimneys – replacement of some windows with PVC. – aluminium entrance doors replacement – equipping the building with central heating – equipping the building with hot water – current repairs of cold water and sewage systems

3. Assessment of the technical condition of the analysed buildings

For the three selected buildings, their technical condition was assessed using the visual and time methods: linear, non-linear, parabolic.

The assessment of the technical condition using the visual method was made on the basis of a detailed assessment of the degree of wear of individual building elements, which were inspected from the inside and outside. The interior of residential premises was not assessed.

The inspection made it possible to describe in detail the technical condition of the basic elements of the buildings and to determine the approximate percentage of their wear. Then, the percentage share of individual building elements was determined, and on this basis, the weighted average degree of wear of the entire building. Then, the percentage share of individual building elements was determined depending on the share in the total costs, which helped to estimate the weighted average degree of wear of the entire building. The type-cost structure was adopted on the basis of the authors' analyses regarding the replacement cost of a given element in the structure of the replacement cost of the facility for a 4-storey multi-family residential building with a basement, in the first quarter of 2023. The weighted average degree of technical wear S_z of the building was determined from the equation:

$$S_z = \sum_{i}^{n} \frac{U_{ei} \cdot S_{z_{ei}}}{100} \tag{3.1}$$

where:

U_{ei} – the share of individual element in the cost of the entire building [%],
S_{zei} – degree of wear of individual element [%],
n – number of elements [–],
i – individual element [–].

The summary of data for the analysed buildings is presented in Tables 2– 4.

Table 2. Average weighted technical wear – building no. 1

<table>
<tr><th>No.</th><th>Building element</th><th>Description of the elements</th><th>Item replacement cost in the item replacement cost structure [%]</th><th>Percentage of the element used [%]</th><th>Degree of technical wear of building elements [%]</th></tr>
<tr><td>1</td><td>Foundations</td><td>Reinforced concrete footings</td><td rowspan="2">6.0</td><td rowspan="2">40</td><td rowspan="2">2.4</td></tr>
<tr><td>2</td><td>Underground walls</td><td>Ceramic brick masonry walls</td></tr>
<tr><td>3</td><td>Basement ceilings</td><td>Reinforced concrete</td><td>3.5</td><td>40</td><td>1.4</td></tr>
<tr><td>4</td><td>Basement floor</td><td>Concrete</td><td>0.6</td><td>50</td><td>0.3</td></tr>
<tr><td>5</td><td>Overground walls</td><td>Ceramic brick masonry walls</td><td>20.0</td><td>30</td><td>6</td></tr>
<tr><td>6</td><td>Overground ceilings</td><td>Reinforced concrete</td><td>14.0</td><td>30</td><td>4.2</td></tr>
<tr><td>7</td><td>Roof construction</td><td>Reinforced concrete</td><td>3.8</td><td>30</td><td>1.14</td></tr>
</table>

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Table 2 – *Continued from previous page*

No.	Building element	Description of the elements	Item replacement cost in the item replacement cost structure [%]	Percentage of the element used [%]	Degree of technical wear of building elements [%]
8	Roofing	Roofing felt heat weldable	6.6	10	0.66
9	Chimneys above the roof	Ceramic bricks, plaster	3.5	10	0.35
10	Roof flashings	Galvanized steel sheet	2.0	10	0.2
11	Gutters	Galvanized steel sheet	0.5	10	0.05
12	Downpipes	Galvanized steel sheet	0.8	10	0.08
13	Staircases	Reinforced concrete covered with terrazzo	3.3	30	0.99
14	Elevation	Styrofoam, thin-layer plaster	6.2	20	1.24
15	Balconies	Reinforced concrete slabs	3.4	20	0.68
16	Window and door joinery	PVC, aluminium	7.0	40	2.8
17	Flashings (window sill)	Coated steel sheet	1.2	20	0.24
18	Sanitary installations	–	8.0	30	2.4
19	Gas installation	–	2.0	30	0.6
20	Central heating installation	–	5.6	30	1.68
21	Electrical Installations	–	2.0	50	1
				Total	28.41

Table 3. Average weighted technical wear – building no. 2

No.	Building element	Description of the elements	Item replacement cost in the item replacement cost structure [%]	Percentage of the element used [%]	Degree of technical wear of building elements [%]
1	Foundations	Reinforced concrete footings	6.0	40	2.4
2	Underground walls	Ceramic brick masonry walls			
3	Basement ceilings	Reinforced concrete	3.5	40	1.4
4	Basement floor	Concrete	0.6	50	0.3
5	Overground walls	Ceramic brick masonry walls	20.0	30	6
6	Overground ceilings	Reinforced concrete	14.0	30	4.2
7	Roof construction	Reinforced concrete	3.8	30	1.14
8	Roofing	Roofing felt heat weldable	6.6	90	5.94
9	Chimneys above the roof	Ceramic bricks, plaster	3.5	100	3.5
10	Roof flashings	Galvanized steel sheet	2.0	100	2
11	Gutters	Galvanized steel sheet	0.5	10	0.05
12	Downpipes	Galvanized steel sheet	0.8	10	0.08
13	Staircases	Reinforced concrete covered with terrazzo	3.3	30	0.99
14	Elevation	Styrofoam, thin-layer plaster	6.2	20	1.24
15	Balconies	Reinforced concrete slabs	3.4	100	3.4

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Table 3 – *Continued from previous page*

No.	Building element	Description of the elements	Item replacement cost in the item replacement cost structure [%]	Percentage of the element used [%]	Degree of technical wear of building elements [%]
16	Window and door joinery	PVC, aluminium	7.0	40	2.8
17	Flashings (window sill)	Coated steel sheet	1.2	20	0.24
18	Sanitary installations	–	8.0	30	2.4
19	Gas installation	–	2.0	30	0.6
20	Central heating installation	–	5.6	30	1.68
21	Electrical Installations	–	2.0	50	1
			Total		41.36

Table 4. Average weighted technical wear – building no. 3

No.	Building element	Description of the elements	Item replacement cost in the item replacement cost structure [%]	Percentage of the element used [%]	Degree of technical wear of building elements [%]
1	Foundations	Reinforced concrete footings	6.0	60	3.6
2	Underground walls	Ceramic brick masonry walls			
3	Basement ceilings	Reinforced concrete	3.5	40	1.4
4	Basement floor	Concrete	0.6	50	0.3
5	Overground walls	Ceramic brick masonry walls	20.0	30	6
6	Overground ceilings	Reinforced concrete	14.0	30	4.2

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Table 4 – *Continued from previous page*

No.	**Building element**	**Description of the elements**	**Item replacement cost in the item replacement cost structure [%]**	**Percentage of the element used [%]**	**Degree of technical wear of building elements [%]**
7	Roof construction	Reinforced concrete	3.8	30	1.14
8	Roofing	Roofing felt heat weldable	6.6	60	3.96
9	Chimneys above the roof	Ceramic bricks, plaster	3.5	10	0.35
10	Roof flashings	Galvanized steel sheet	2.0	50	1
11	Gutters	Galvanized steel sheet	0.5	60	0.3
12	Downpipes	Galvanized steel sheet	0.8	40	0.32
13	Staircases	Reinforced concrete covered with terrazzo	3.3	60	1.98
14	Elevation	Styrofoam, thin-layer plaster	6.2	90	5.58
15	Balconies	Reinforced concrete slabs	3.4	90	3.06
16	Window and door joinery	PVC, aluminium	7.0	50	3.5
17	Flashings (window sill)	Coated steel sheet	1.2	30	0.36
18	Sanitary installations	–	8.0	30	2.4
19	Gas installation	–	2.0	30	0.6
20	Central heating installation	–	5.6	30	1.68
21	Electrical Installations	–	2.0	50	1
				Total	42.73

The degree of technical wear of the S_z object on the basis of time methods was also determined by the linear, non-linear, and the parabolic methods. Time methods are based on the use of the age of the building structure t and the expected durability period of the structure T in the calculations. The degree of technical wear of buildings S_z, based on time methods for the analysed buildings, was determined in accordance with Equations (3.2)–(3.4):

– linear method (proportional method):

$$S_Z = \frac{t}{T} \cdot 100\% \tag{3.2}$$

– non-linear method (Unger and Eytelwein method):

$$S_Z = \frac{t \cdot (t + T)}{2 \cdot T^2} \cdot 100\% \tag{3.3}$$

– parabolic method (Ross method):

$$S_Z = \frac{t^2}{T^2} \cdot 100\% \tag{3.4}$$

In the time methods, the age of the buildings t was assumed according to age of analysed buildings, while the durability of the buildings $T = 120$ years. Degree of technical wear of analysed buildings using time methods are presented in Table 5.

Table 5. Degree of technical wear of analysed buildings using time methods

Building no.	**Normative shelf life [years]**	**Year of construction**	**Year of inspection**	**Lifetime [years]**	**Degree of technical wear**		
					Linear method [%]	**Non-linear method [%]**	**Parabolic method [%]**
I	120	1954	2022	68	56.67	44.39	32.11
II	120	1959	2022	63	52.50	40.03	27.56
III	120	1052	2022	70	58.33	46.18	34.03

4. Discussion

The analysis of the degree of technical wear for evaluated buildings showed that different results were obtained using the visual method and the time methods. The degree of technical wear for the analysed buildings is shown in Fig. 5–7.

When analysing the degree of technical wear of the assessed buildings, different results were obtained using the visual and time methods. In the case of building no. 1, i.e., a building characterized by proper renovation management, the lowest degree of wear of the building

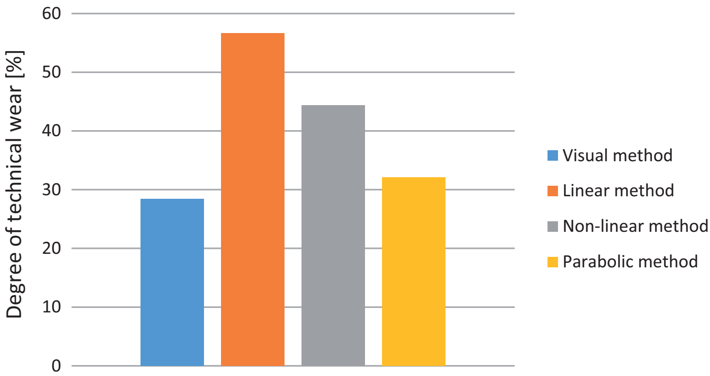

Fig. 5. Degree of technical wear – building no. 1

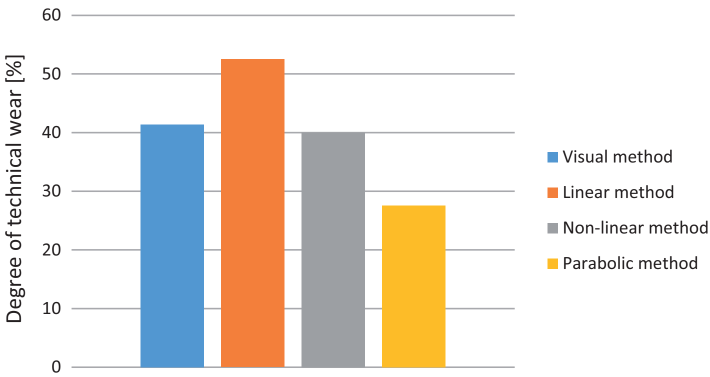

Fig. 6. Degree of technical wear – building no. 2

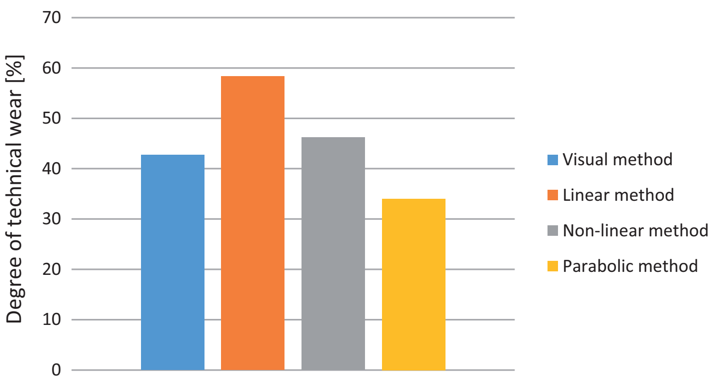

Fig. 7. Degree of technical wear – building no. 3

S_z = 28.41% was obtained using the visual method. This value is close to the value obtained from calculations based on the parabolic method (S_z = 32.11%).

In the case of building no. 2, i.e., a building renovated without proper supervision, the wear rate of the building was S_z = 41.36% and was close to the value obtained from the calculations using the non-linear method (S_z = 40.03%).

In the case of building no. 3, i.e., the building where only necessary repairs were carried out, the wear rate was 42.73% and, similarly to building no. 2, it was close to the value obtained from calculations using the non-linear method (S_z = 46.18%).

The difference between the obtained values of S_z indicators in building no. 1 resulted from lower value of percentage of the element used which was on average level of 27%, while for building no. 2 and 3 it was 44% and 46% respectively. For building no. 2 the percentage of the used roofing, chimneys above the roof, roof flashings and balconies was 90–100%, while for building no. 3 the higher value of percent of the used elements (90%) was obtained for elevation and balconies. The degradation of the mentioned elements in building no.1 was determined at 10–20%.

The above results confirm the fact that the aging process of a building depends not only on its age, but also on the renovation management. Time methods do not reflect the actual degree of wear and tear of the facility, the renovation works, and their quality. The analyses carried out showed that in the case of buildings no. 2 and 3, the degree of wear and tear, determined by the visual method, is similar despite the renovation management carried out differently. Extensive renovations were conducted in building no. 2, but without proper supervision, which led the building to a state similar to that of a building in which only necessary renovations were carried out.

Based on the analyses carried out, it was found that the incompetent management of the building and repair works carried out in an ad hoc or incorrect manner are one of the basic reasons for the degradation of a building. A considerable problem in cooperation with owners of residential buildings is also the lack of awareness of the need to "service" buildings, including the need to diagnose the technical condition during necessary renovation or modernization works.

The above analyses show that the visual method is the most accurate to determine the degree of wear and tear of the building, as it determines the actual condition, including the renovations carried out and their quality. When choosing calculation methods to determine the degree of wear and tear of a building or to forecast the aging of a building, it is necessary to first identify the factors influencing the degradation of the building, the renovations carried out and their quality. Determining the degree of wear of an object or forecasting its aging process in the future without a thorough recognition of the factors affecting the degradation of the building often leads to erroneous results.

5. Conclusions

The article presents the determination of the degree of wear and tear of multi-family residential buildings made in traditional technology with the use of visual and computational methods. The analysis showed that a multi-family residential building with defective repairs has a similar degree of wear and tear to a building where only necessary repairs were carried out.

Based on the results of this analysis the following conclusions are reached:

- similar results were obtained using the visual method and time methods;
- for building no. 1, the lowest degree of wear of the building S_z = 28.41% was obtained using the visual method, which was close to the value obtained from calculations based on the parabolic method (difference of 3.70%);
- in the case of buildings no. 2 and 3, the wear rate was S_z = 41.36% and S_z = 42.73%, respectively and was close to the value obtained from the calculations using the non-linear method (the differences were 1.43% and 3.45%, respectively);
- in the case of building no. 1, the difference in value S_z obtained using visual and non-linear method was approximately 16.00%; this discrepancy can be explained by the lower percentage of elements used in building no. 1.

The visual method is the most accurate to determine the degree of wear and tear of the building because it determines the actual condition of the facility, taking into account the renovations and their quality. When choosing computational methods for predicting the aging of a building, it is necessary to identify the factors influencing the degradation of the building, the renovations and their quality. Determining the degree of wear of an object or forecasting its aging process in the future without a thorough recognition of the factors affecting the degradation of the building often leads to erroneous results.

The existing methods of forecasting changes in the functional properties of residential buildings are only helpful tools when the right decisions in planning construction works are made and the quality of renovation works is taken into consideration. Further research aimed at improving existing methods should be conducted to obtain results close to the real situation.

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Wpływ utrzymania należytego stanu technicznego na starzenie się budynków mieszkalnych wielorodzinnych

Słowa kluczowe: stan techniczny budynku, budynek mieszkalny wielorodzinny, starzenie się budynku, technologia tradycyjna, uszkodzenia budynku

Streszczenie:

Utrzymanie należytego stanu technicznego budynków mieszkalnych wielorodzinnych jest jednym z najistotniejszych czynników determinujących proces ich starzenia się. Zgodnie z art. 61 ustawy Prawo budowlane właściciel lub zarządca obiektu budowlanego jest obowiązany utrzymywać i użytkować obiekt zgodnie z jego przeznaczeniem i wymaganiami ochrony środowiska oraz utrzymywać w należytym stanie technicznym i estetycznym, nie dopuszczając do nadmiernego pogorszenia jego właściwości użytkowych i sprawności technicznej, a także zapewnić bezpieczne użytkowanie obiektu w razie wystąpienia czynników zewnętrznych oddziaływujących na obiekt, związanych z działaniem człowieka lub siłnatury. Zgodnie z art. 62 ustawy Prawo budowlane oraz Rozporządzeniem Ministra Spraw Wewnętrznych i Administracji z dnia 16 sierpnia 1999 r. w sprawie warunków technicznych użytkowania budynków mieszkalnych obowiązkiem właściciela lub zarządcy obiektu budowlanego jest poddawanie kontroli okresowej budynków co najmniej raz w roku przez osoby uprawnione, w celu zdiagnozowania usterek. Zgodnie z tym Rozporządzeniem protokoły z kontroli powinny stanowić podstawę do sporządzenia zestawienia robót remontowych budynków. Tymczasem rzeczywistość pokazuje, że nie wszystkie budynki poddawane są regularnym kontrolom okresowym i niezbędnym naprawom w trakcie ich użytkowania, a wiele z wykonywanych remontów jest przeprowadzanych w sposób nieprawidłowy. Prowadzi to do obniżania właściwości użytkowych poszczególnych jego składowych oraz przyspieszenia procesu starzenia się budynków.W trakcie procesu użytkowania budynków, szczególnie nie poddawanych regularnym kontrolom okresowym, przydatna jest prognoza procesu starzenia się budynków. Zgodnie z normą przewidywanie degradacji budynku powinno polegać na prognozowaniu zmian właściwości użytkowych w czasie. W tym celu zgodnie z normami należy opracować procedury związane z przewidywanym okresem użytkowania budynków oraz program starzenia uwzględniający najbardziej istotne mechanizmy degradacji. W referacie przeanalizowano 100 budynków mieszkalnych wielorodzinnych podpiwniczonych wykonanych w technologii tradycyjnej, o powierzchni użytkowej od 604,50 m^2 do 2315,00 m^2, wybudowanych w latach 1952–1958 w województwie mazowieckim. Dla analizowanych budynków dokonywano raz w roku kontroli poszczególnych elementów oraz określano ich stan techniczny. Badania prowadzono w latach 2018–2022. Wyniki przeprowadzonych przez Autorów badań posłużyły do określenia metodą wizualną stopnia ich starzenia się i porównania otrzymanych wyników z wynikami otrzymywanymi z metod obliczeniowych, m.in. z metod czasowych: liniowa, nieliniowa, paraboliczna. Główny nacisk w artykule położono na wykonywanie remontów obiektów w sposób wadliwy, często bez odpowiedniego nadzoru i wpływu tego zjawiska na przyspieszone starzenie się budynków. Jest to zjawisko powszechne, ale nieuwzględniane w powszechnie znanych metodach prognozy starzenia budynków. W referacie przedstawiono również analizę dotyczącą występowania najczęstszych usterek na obiektach oraz prowadzonej gospodarki remontowej na podstawie zaleceń pokontrolnych.

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