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POLISH ACADEMY OF SCIENCES BRANCH IN LUBLIN

TEKA

KOMISJI
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Retrospekcja o genezie i trwałości powojennych polichromii kamienic Starego Rynku w Poznaniu

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Streszczenie: Artykuł prezentuje autorskie doświadczenia twórcze artysty i jednocześnie badacza, związane z wykonaniem dekoracji malarskiej kamienic na Starym Rynku, w Poznaniu. Są to dzieła powstałe w latach: 1986, 1994 oraz 1997.

Pierwsza realizacja była konsekwencją dość niespodziewanego włączenia w dzieło powstawania polichromii kamienic na Starym Rynku, w Poznaniu. Było to, po około 30 latach po powstaniu polichromii na zrekonstruowanych kamieniczkach, po II Wojnie Światowej. Zaistniała potrzeba odtworzenia dekoracji malarskiej autorstwa Edmunda Łubowskiego, na kamienicy na Starym Rynku 39 oraz sgraffita[1], autorstwa Józefa Fliegera, na Starym Rynku 99. Sytuacja była konsekwencją tak dalekiej destrukcji, że nie można było poddać tych dzieł odnowieniu. Z uwagi, iż autorzy jeszcze wtedy żyli, możliwe było konsultowanie przebiegu ich odtworzenia.

W 1994 roku autor otrzymał kolejną propozycję wykonania, według autorskiego projektu, nowej dekoracji malarskiej na kamienicy na Starym Rynku 66, która została wykonana w technice mokrego fresku[2]. Później, w 2010 r. została przeprowadzona konserwacja i restauracja tego dzieła, przebieg prac odbywał się w konsultacji z autorem.

W 1997 zaprojektowano dekorację malarską na kamienicy przy ul. Paderewskiego 3, blisko wnętrza urbanistycznego Starego Rynku. W oparciu o projekt, wykonano malarską dekorację w technice silikatowej[3].

Doświadczenie artysty, wyniesione z tych wymienionych prac, stały się przedmiotem badań jakościowych, które korelują ze sobą upływ czasu i rodzaj stosowanych technik malarstwa ściennego oraz innych uwarunkowań technicznych wpływających na stan zachowania polichromii z problematyką artystyczną.

Słowa kluczowe: architektura, odbudowa, polichromia, Stary Rynek w Poznaniu, spoiwa mineralne, stan zachowania, konserwacja, restauracja

Syntetyczny rys historyczny

Poznań to jedno z najstarszych miast Polski, do lat 40. XIII wieku istniał na prawym brzegu Warty, jako potężny gród Ostrów Tumski wraz osadą targową Śródką[4].

W XIII wieku zaistniała potrzeba stworzenia miasta spełniającego wymogi ówczesnych czasów i nastąpiły przygotowania do jego lokacji na lewym brzegu Warty, gdzie istniały trzy osady: Św. Gotarda, Św. Marcina

1 K. Zwolińska, *Sgraffito*, w: *Mała technologia malarstwa*, Wydawnictwo Centralnego Ośrodka Metodyki Upowszechniania Kultury, Warszawa 1989, s. 168.

2 Ibidem, *Fresk* s. 149.

3 P. Przybek, *Farby silikatowe*, w: *Materiały Malarskie*, Wydawnictwo 400 d&, Kraków 2004, s. 23.

4 A. Rogalanka, *Poznań u progu lokacji. Na prawym brzegu Warty*, rozdz. VII, *Lokacja miasta na lewym brzegu Warty w 1253 roku*, w: Jerzy Topolski (red), *Dzieje Poznania*, tom I, PWN, Warszawa-Poznań 1988, s. 146–150.

i Św. Wojciecha. Książę Przemysł I w roku 1244, po zamianie z biskupem osady Św. Wojciecha, na osadę Św. Gotarda, przeniósł siedzibę zakonu dominikanów, ze Śródki na teren osady Św. Gotarda, na lewym brzegu Warty[5].

W 1253 roku na terenie osady ukończono budowę wczesnogotyckiego kościoła należącego do zakonu dominikanów. Także w 1253 roku powstał dokument lokacyjny, z inicjatywy braci: książąt Przemysła I oraz Bolesława Pobożnego, zlecający Tomaszowi z Gubina osadzenie miasta na prawie magdeburskim[6]

Miasto posiadało centralny rynek, w kształcie zbliżonym do kwadratu o boku około 140 m, z układem odchodzących od niego 12 ulic, po 3 na każdą pierzeję z głównymi, wylotowymi ulicami wychodzącymi ze środka pierzei północnej i południowej, tworzącymi główną oś założenia miasta. Wokół rynku, na ośmiu blokach, zostały wytyczone parcele mieszkalne[7].

Początkowo działki były zabudowywane obiektami drewnianymi, dopiero od schyłku XV wieku drewniana zabudowa była zastępowana obiektami murowanymi[8].

W lutym 1945 roku został zniszczony, na skutek działań wojennych, w 60% Stary Rynek i jego najbliższe otoczenie. Zbigniew Zieliński, architekt, kierownik Wydziału Planowania i Rozbudowy Miasta w lipcu 1946 roku przedstawił plan zabudowy zabytkowego centrum, a 1947 roku opracował pierwsze rysunki rekonstrukcji elewacji. Rekonstrukcje odwoływały się XVIII wieku czyli do czasów przedrozbiorowych. W 1954 roku powstał jednorodny, pozbawiony nawarstwień historycznych projekt pierzei rynkowych[9].

Przygotowano kompleksową dokumentację architektoniczną oraz w końcu 1954 roku zajęto się kolorystycznym opracowaniem elewacji, traktując wnętrze urbanistyczne Starego Rynku, jako zharmonizowaną całość. W przeciwieństwie do przekazów ikonograficznych o architekturze kamienic na Starym Rynku w Poznaniu przekazy o polichromii istniejącej w przeszłości były skąpe lub w wielu przypadkach nie było ich wcale. W związku z powyższym podjęto się nowego twórczego poszukiwania. W wyniku konkursu ostatecznie na początku 1955 roku przyjęto projekt artysty plastyka Zbigniewa Bednarowicza, który został generalnym projektantem i koordynatorem prac plastycznych. Szczegółowe projekty polichromii wykonywane były przez zespoły i poszczególnych artystów plastyków, W pracach uczestniczyli artyści plastycy głównie ze środowiska poznańskiego[10]

Dekoracja malarska kamienicy na Starym Rynku 66

Propozycja wykonania nowej dekoracji malarskiej na elewacji kamienicy na Starym Rynku 66 w Poznaniu pojawiła się w 1994 roku. Nie bez znaczenia dla wyboru artysty był fakt jego doświadczeń z młodych lat i możliwość obserwacji odbudowy Starego Rynku, w tym uczestnictwo w niej, w zakresie wystroju plastycznego Edmunda Łubowskiego[11], stąd pierwsza fascynacja powstawaniem polichromii budynków tam odbudowywanych. Istotna była również bliskość środowiska artystów plastyków uczestniczących w tym dziele, które było w tamtych latach o wiele bardziej zintegrowane niż obecnie.

Nie sposób nie docenić ówczesnego wysiłku osób zaangażowanych w odbudowę Starego Rynku, mimo panujących wtedy uwarunkowań gospodarczych, ustrojowych i ideologicznych, był to heroiczny wysiłek zwieńczony satysfakcjonującym rezultatem.

Istotny jest wiek artysty, w szczególności moment, kiedy historyczna przeszłość staje się ważna i będącego w trakcie realizacji jego zainteresowań historią i zabytkami Poznania oraz całej Polski, jak to miało miejsce przy tworzeniu przez niego nowej polichromii.

5 Ibidem, *Na lewym brzegu Warty,* s. 163–166.

6 Z. Kaczmarczyk, *Ustrój miasta lokacyjnego*, rozdz. VII, *Lokacja miasta na lewym brzegu Warty w 1253 roku*, w: Jerzy Topolski (red), *Dzieje Poznania*, tom I, PWN, Warszawa-Poznań 1988, s. 186.

7 P. Wawrzyniak, *Najdawniejsze dzieje Starego Rynku. Próba podsumowania badań archeologicznych,* w: *W cieniu ratuszowej wieży*, Kronika Miasta Poznania, 2003/2, Poznań 2003, s. 7.

8 A. Gąsiorowski, *Późnośredniowieczna konurbacja poznańska*, rozdz. VIII, *Miasto późnośredniowieczne*, w: Jerzy Topolski (red), *Dzieje Poznania*, tom I, PWN, Warszawa-Poznań 1988, s. 223–224.

9 G. Klause, *Próba nowego spojrzenia na problem odbudowy Starego Rynku,* w: *W cieniu ratuszowej wieży*, Kronika Miasta Poznania, 2003/2, Poznań s. 450–451.

10 H. Kondziela, *Konserwatorstwo,* w: T. Kostyrko (red), *Sztuki plastyczne w Poznaniu,* Wydawnictwo Poznańskie, Poznań 1987, s. 161.

11 Edmund Łubowski – artysta plastyk, ojciec Pawła i Andrzeja Macieja Łubowskich.

Kamienica na Starym Rynku 66 ma XV wieczny rodowód, była kilkakrotnie przebudowywana, w pierwszej połowie XVIII wieku, następnie w drugiej połowie XIX wieku i podwyższona o jedno piętro, w 1945 roku została zniszczona. W 1956 roku odbudowano ją od parteru na średniowiecznej działce. Projekt budynku wykonała Janina Czarnecka. Fasada została pokryta polichromią wykonaną przez zespół artystów plastyków w składzie: Bartłomiej Kurka, Andrzej Matuszewski i Irena Psarska.

Po wykonaniu prac blacharsko – dekarskich i elewacyjnych w 1982 roku Andrzej Matuszewski zaprojektował dekorację malarską, która została wykonana w technice akrylowej[12].

Wykonawstwo w 1994 było realizowane wg wcześniejszego projektu z 1988 roku. Prawdopodobnie z powodu tego, że stan zachowania poprzedniej realizacji z 1982 roku był zły, choć być może były jeszcze jakieś inne uwarunkowania.

Na kamienicy przy Starym Rynku 66 były wcześniejsze powojenne polichromie, lecz Biuro Miejskiego Konserwatora Zabytków zaleciło zaprojektowanie zupełnie nowej dekoracji malarskiej, bez sugerowania się poprzednimi projektami. Autor otrzymał w 1994 roku pozwolenie na projektowanie i wykonawstwo malarstwa ściennego w obiektach zabytkowych.[13]

Główny projektant polichromii Starego Rynku Zbigniew Bednarowicz, ustalił kolorystykę elewacji i technikę wykonania dekoracji malarskiej, zaproponował mokry fresk.

Projekty polichromii kamienic w czasach odbudowy Starego Rynku w swej estetyce nawiązywały, do współczesnych autorom, tendencji w plastyce, takie było założenie. Trzeba przyznać, że pomimo, iż na początku odbudowy panowała doktryna socrealizmu, to w polichromiach kamienic Starego Rynku tego nie widać.

Od momentu zaprojektowania polichromii elewacji kamienicy już w 1988 roku, w sztukach plastycznych pojawiły się inne tendencje, natomiast od procesu odbudowy Starego Rynku minęło około 30 lat. Wiadomo, że wiek XX był burzliwy w kwestii powstawania i zmian tendencji w sztuce. W sztukach plastycznych, 1988 rok, w którym powstał projekt był już zupełnie innym czasem, wielka narracja awangardowa załamała się, kryterium nowości przestało obowiązywać, artyści zaczęli odważnie sięgać do stylistyk przeszłości, cytując je w swoich dziełach. Stąd właśnie zainteresowania historią, skłoniło autora do sięgnięcia do ikonografii arrasów wawelskich, nadającej się do przełożenia na inne medium, jakim jest malarstwo ścienne (ryc. 5). Był jeszcze jeden powód sięgnięcia do arrasów wawelskich, były one wyposażeniem Wawelu, siedziby królewskiej, a przecież Poznań był miastem królewskim i związki Poznania ze stolicą Polski, Krakowem były przez kilka wieków rozkwitu Polski bardzo istotne.

Kolor elewacji był ustalony przez Zbigniewa Bednarowicza, była to stonowana, zimna zieleń, obramienia okienne były kremowe, dużo jaśniejsze. Dążono do tego, by rozmieścić elementy kompozycji tak, jak w tkaninach ozdobnych np. dywanach równomiernie po całej powierzchni malatury, od końca parteru do szczytu kamienicy. Między oknami pierwszego i drugiego piętra wydzielono poziomy pas lekko jaśniejszy, ograniczony dwoma białymi liniami, pozwalający ustosunkować się do architektury, z fantazyjnymi postaciami zaczerpniętymi z ikonografii arrasów ze skrzydłami i zawiniętymi, przypominającymi rybie, ogonami i trzymającymi w rękach niebieskie wazy. Dwa pionowe pasy umieszczono także na szczycie fasady. Resztę powierzchni oplata wić roślinna, ugrowa winorośl z niebieskimi gronami, dodano również kilka stylizowanych czerwonych kwiatów. Jeżeli chodzi o kolory przeważa ugier, postacie są malowane sieną paloną, modelowane z przewagą ciemnych płaszczyzn, aby wyłaniały się z powierzchni malowidła, to samo dotyczy ugrowych liści winogron, są różnicowane w walorze w tym samym celu i kontrastują z zielonkawym tłem. Nad oknem, na szczycie elewacji umieszczono stylizowaną, podpiętą z dwóch stron, kotarę w kolorze jasnego ugru.

Polichromię wykonano w technice mokrego fresku, malując na niewielkich powierzchniach barwionej, mokrej zaprawy, nakładanej sukcesywnie przez tynkarza. Istotne było zwracanie nieustanne uwagi, żeby zaprawa nie była zbyt sucha, bo mogłaby się nie związać z pigmentami rozprowadzonymi wodą wapienną, jako rozcieńczalnikiem. W prawidłowo wykonanym fresku kolorowe pigmenty wiążą się na stałe z tynkiem, zawierającym gaszone wapno. Trudnością jest także to, że tynk jaśnieje po wyschnięciu, trzeba więc mieć wyczucie, żeby nie przebielić malatury. Ta stara technika jest bardzo szlachetna i można w niej dość elastycznie operować środkami.

12 H. Kondziela, *Stary Rynek, Kamienica 66, Sprawozdania konserwatorskie z prac w latach 1945–2016*, część 2, w: I. Błaszczyk (red), *Stare Miasto w Poznaniu. Zniszczenia Odbudowa Konserwacja 1945–2016,* Wydawnictwo Miejskie Posnania, Poznań 2017, s. 206.

13 Zaświadczenie nr 22/94 Wojewódzkiego Konserwatora Zabytków w Poznaniu o posiadaniu kwalifikacji w zakresie projektowania i realizacji malarstwa ściennego w obiektach zabytkowych.

Dekorację malarską wykonywano na tradycyjnych, drewnianych, rusztowaniach tak, jak to robili artyści plastycy po wojnie, w czasie odbudowy Starego Rynku.

Po 16 latach, w 2010 roku odnowiona została fasada z wystrojem malarskim. Wystrój malarski został poddany udanej konserwacji i restauracji (ryc. 1 i 2). Obecnie, po dziesięciu latach wygląda dobrze (ryc. 3), prawie tak jak po wykonaniu w 1994 roku. Zmieniony został kolor obramień okiennych na ciemny ugier, w myśl sugestii Marii Strzałko, ówczesnej Miejskiej Konserwator Zabytków, co spowodowało większą wyrazistość dekoracji malarskiej.

Ryc. 1. Kamienica na Starym Rynku 66, przed konserwacją i restauracją, fresk, 1994 r., fotografia przed 2010 r.

Ryc. 2. Kamienica na Starym Rynku 66 po wymianie rynien i konserwacji i restauracji polichromii w 2010 r.

Doświadczenia z innymi kamienicami

W 1997 ówczesny Miejski Konserwator Zabytków Witold Gałka zaproponował zaprojektowanie i wykonanie kolejnej dekoracji malarskiej na kamienicy przy ul. Paderewskiego 3, niedaleko Starego Rynku.

Kamienica ta była odbudowana w formach pseudobarokowych, na siedzibę, nieistniejącego już, Pomorskiego Banku Kredytowego. Obecnie znajduje się tam siedziba Oddziału Banku PKO SA w Poznaniu. Budynek postawiono częściowo na pozostałościach starszej budowli[14].

14 A. Dolczewska, *Ulica Paderewskiego, Kamienica ul. Paderewskiego 3, Sprawozdania konserwatorskie z prac w latach 1945–2016*, część 2, w: I. Błaszczyk (red), *Stare Miasto w Poznaniu. Zniszczenia Odbudowa Konserwacja 1945–2016,* Wydawnictwo Miejskie Posnania, Poznań 2017, s.291–292.

Na elewacji kamienicy przy ul. Paderewskiego 3 nie było w przeszłości dekoracji malarskiej, powstał zupełnie nowy projekt. Zaprojektowano bogatą dekorację malarską, sięgając do ikonografii z arrasów wawelskich. Pojawiły się tam fantazyjne zwierzęta, a całość elewacji była pokryta dekoracyjnymi elementami. Zleceniodawca nie chciał się zgodzić na rozbudowaną polichromię i w rezultacie powstała bardziej oszczędna, delikatna kompozycja. Znajduje się na niej wić roślinna, róg obfitości, dwie niebieskie wazy oraz w kilku miejscach na elewacji, przewijają się dekoracyjne wstęgi.

Uwarunkowania techniczne wynikające z użycia farb silikatowych, spowodowały, że cała kompozycja ma bardziej graficzny charakter, niż to ma miejsce na wykonanej w technice fresku, elewacji kamienicy na Starym Rynku 66. Technika wykonania była uwarunkowana tym, że elewacja została przygotowana w technice silikatowej. Do malowania dekoracji malarskiej użyto także farb silikatowych. Nie wszystkie kolory farb silikatowych udało się zdobyć i stąd w śladowej ilości odstąpiono od czystości technologicznej fragmentów malatury, używając pigmentu ze spoiwem akrylowym, przeznaczonym do malarstwa ściennego, co zupełnie nie wpłynęło na ich trwałość. Obecnie po 24 latach sama dekoracja wygląda dobrze, jest to wynikiem techniki silikatowej i systemu odprowadzania wody z dachu budynku, rynny nie przechodzą przez elewację. Pewne zmiany nastąpiły w samym tle, czyli w warstwie położonej pod malaturą. Natomiast sama dekoracja malarska wykazuje znacznie większą trwałość niż w przypadku mokrego fresku (ryc. 4).

W latach 1985–1986, w czasie kiedy prezydentem Poznania był Andrzej Wituski, przeprowadzono rewaloryzację polichromii kamienic na Starym Rynku, w Poznaniu pod nadzorem Zbigniewa Bednarowicza oraz przy udziale artystów plastyków, którzy opracowali pod względem plastycznym, poszczególne elewacje w okresie odbudowy[15].

Właśnie podczas tej rewaloryzacji doszło do odtworzenia w 1986 roku wraz z artystą Pawłem Łubowskim[16] fresku z 1955 roku, autorstwa Edmunda Łubowskiego, na elewacji kamienicy na Starym Rynku 39[17] oraz sgraffita autorstwa Józefa Fliegera na kamienicy nr 99[18] z 1960 roku. Pierwsza z tych kamienic była odtwarzana po konturze zachowanej malatury, a druga była odtwarzana od początku poprzez nakładanie trzech warstw barwionej zaprawy i jej cięcia według na nowo rozrysowanego kartonu.

Problemy estetyczne i techniczne

Wystrój plastyczny na Starym Rynku w Poznaniu wykonany po II Wojnie Światowej był realizowany według wytycznych architektów i urbanistów z zespołu kierowanego przez Zbigniewa Zielińskiego wyrażonych takimi słowami: *...Rekonstrukcja w stylu poszczególnych epok nie może tutaj mieć miejsca z braku jakiejkolwiek dokumentacji i śladów dawnej polichromii. Malując Stary Rynek, należy sięgnąć nie tylko do dawnych poznańskich motywów i wzorów, ale przede wszystkim należy się starać, aby dekoracja malarska odpowiadała wymogom współczesnej nam sztuki i aby kolorystycznie stała na najwyższym poziomie, do jakiego doszła sztuka współczesna. Przyszłe pokolenia muszą mieć pełną świadomość, że oglądają na fasadach kamieniczek malowidła z roku 1955, że widzą powodu sztukę z połowy XX wieku, zharmonizowaną z elementami poznańskiego renesansu, baroku i klasycyzmu*[19].

15 I. Błaszczyk, *Stary Rynek, Sprawozdania konserwatorskie z prac w latach 1945–2016*, część 2, w: I. Błaszczyk (red), *Stare Miasto w Poznaniu. Zniszczenia Odbudowa Konserwacja 1945–2016* Wydawnictwo Miejskie Posnania, Poznań 2017, s. 168–169.

16 Paweł Łubowski to brat autora Andrzeja Macieja Łubowskiego.

17 H. Kondziela, *Stary Rynek, Kamienica Stary Rynek 39, Sprawozdania konserwatorskie z prac w latach 1945–2016*, część 2, w: I. Błaszczyk (red), *Stare Miasto w Poznaniu. Zniszczenia Odbudowa Konserwacja 1945–2016,* Wydawnictwo Miejskie Posnania, Poznań 2017, s. 186.

18 H. Kondziela, *Stary Rynek, Kamienica Stary Rynek 97/100, Sprawozdania konserwatorskie z prac w latach 1945–2016*, część 2, w: I. Błaszczyk (red), *Stare Miasto w Poznaniu. Zniszczenia Odbudowa Konserwacja 1945–2016,* Wydawnictwo Miejskie Posnania, Poznań 2017, s. 225.

19 M. Brzeziński, Powojenna Odbudowa Starego Rynku, https://www.miastopoznaj.pl/blogi/pozostale/2066-powojenna-odbudowa-starego-rynku, Poznań 2015.

Ryc. 3. Kamienica na Starym Rynku 66, fresk. Stan obecny 10 lat po konserwacji i restauracji, fot. Krzysztof Ślachciak, 2020 r.

Ryc. 4. Polichromia kamienicy przy ul. Paderewskiego 3, silikat, 1997 r., fot. Krzysztof Ślachciak, 2020 r.

Sposób odbudowy Starego Miasta w Poznaniu i w innych miastach Polski po II Wojnie Światowej został ukierunkowany względami emocjonalnymi i tożsamościowymi, wbrew wykładni sformułowanej na początku XX wieku przez austriackiego historyka sztuki Aloisa Riegla dotyczącej konserwacji zabytków. Uważał on, że konserwacja powinna dotyczyć tylko zachowanej materii zabytkowej wraz z nawarstwieniami, był to głos opowiadający się za autentyzmem. Do dzisiaj toczą się spory w tej kwestii, w przypadkach odbudowy kompletnie zniszczonych zabytkowych budynków[20]. Odmienną drogą, wytyczoną przez odbudowę Starego Miasta w Warszawie, za którą stała myśl ówczesnego generalnego konserwatora zabytków prof. Jana Zachwatowicza, podążyły inne miasta Polski[21]. Trzeba jednak stwierdzić, że odbudowa Starego Miasta w Warszawie stworzyła dzieło sztuki, będące dokumentem epoki, podlegającym ochronie konserwatorskiej i które w 1980 r. zostało wpisane na listę światowego dziedzictwa kulturowego UNESCO.

Odbudowany Stary Rynek w Poznaniu także stał się dokumentem powojennych czasów i powstałe w tamtym czasie realizacje plastyczne stają się zabytkami.

Warunki wynikające z klimatu i problemów technicznych powodują, że wystrój plastyczny kamienic ulega degradacji i istnieje stała potrzeba działań naprawczych. Przyczyną są często niedrożne rynny, ściekająca woda zmywa freski i destruuje tynki. Szczególnie narażone są też szczyty kamienic, gdzie na skutek większego wystawienia na opady atmosferyczne zanikają znajdujące się tam malatury.

20 A. Riegl, *Nowe prądy w dziedzinie opieki nad zabytkami*, w: R. Kasprowicz, *Alois Riegl, Georg Dehio i kult zabytków*, Oficyna Wydawnicza „Mówią Wieki", Warszawa 2006, s. 92–95, 102–103.

21 J. Zachwatowicz, *Założenia, tezy i metody*, w: *Ochrona zabytków w Polsce*, rozdz. IV, *Ochrona zabytków po drugiej wojnie światowej*, Wydawnictwo Polonia, Warszawa 1965, s. 44–46.

Ryc. 5. Z kręgu Cornelisa Florisa i Cornelisa Bosa, warsztat Fransa Ghieteelsa?, Arras z monogramem Zygmunta Augusta, 287×410 cm, wełna, jedwab, nić srebrna, nić złota, Bruksela, Flandria, Zamek Królewski na Wawelu Państwowe Zbiory Sztuki, ok. 1555 r.

Przedstawione działania naprawcze wymienione powyżej, udokumentowane w literaturze na podstawie sprawozdań konserwatorskich nakłaniają do ich zestawienia w tabelach.

Tabela 1. Działania naprawcze

Lokalizacja kamienicy	Technika	Rok powstania	Rok odtworzenia	Rok konserwacji i restauracji	Stan zachowania 2021 r.
Stary Rynek 99	sgraffito	1960	1985	–	zły
Stary Rynek 39	mokry fresk	1956	1986	2011	dobry
Stary Rynek 66	mokry fresk	1994	–	2010	dobry
Paderewskiego 3	farby silikatowe	1997	–	–	dobry

Tabela 2. Przedziały czasowe pomiędzy działaniami naprawczymi

Lp.	Kamienica	Przedział czasowy
1.	Kamienica przy Starym Rynku 99 (sgraffito)	od powstania do otworzenia – 25 lat, od otworzenia do chwili obecnej – 36 lat
2.	Kamienica na Starym Rynku 39 (mokry fresk)	od powstania do otworzenia – 30 lat, od odtworzenia do konserwacji i restauracji – 25 lat
3.	Kamienica przy Starym Rynku 66 (mokry fresk)	od powstania do konserwacji i restauracji – 16 lat
4.	Kamienica przy ul. Paderewskiego 3 (farby silikatowe)	od powstania do chwili obecnej (2021 r.) jest w dobrym stanie – 24 lata

Tabela 3. Zestaw czynników wpływających na stan polichromii

Podstawowe czynniki wpływające na stan zachowania polichromii
1. Technika wykonania
2. Błędy technologiczne
3. Warunki atmosferyczne
4. Zanieczyszczenie środowiska
5. Wadliwy system odprowadzenia wody z dachu

Okazuje się, że polichromie kamienic przy Starym Rynku 66 (1994) i Paderewskiego 3 (1997) wykonane od nowa w różnych technikach wykazują inną trwałość. Polichromia na kamienicy przy Starym Rynku 66 wykonana w technice mokrego fresku po 16 latach musiała być poddana konserwacji i restauracji, a dekoracja malarska na kamienicy przy ul. Paderewskiego 3, wykonana w technice krzemianowej (silikat), po upływie 24 lat jest w dobrym stanie.

W latach 2010–2012 elewacje kamienic przy Starym Rynku 39 i 66 były odnawiane i przy okazji dekoracje malarskie były poddane konserwacji i restauracji przez osoby z uprawnieniami konserwatorskimi.

Sgraffito na kamienicy 99 nie było konserwowane i restaurowane w 2012 r. przy okazji odnowienia sąsiednich elewacji i jest w złym stanie, nie wiadomo czy dekorację malarską da się uratować. Natomiast dokonana w 2012 r. w jej pobliżu na kamienicy 97 konserwacja i restauracja dekoracji wykonanej w technice sgraffita spowodowała, że polichromia na niej jest obecnie w dobrym stanie zachowania.

Stan zachowania w 2021 r. wszystkich wymienionych polichromii autor artykułu stwierdził osobiście po przeglądzie elewacji poszczególnych kamienic.

Krótka charakterystyka użytych technik malarskich

Na zewnątrz budynków w celu zachowania trwałości polichromii budynków stosuje się spoiwa mineralne.

W wyżej wymienionych realizacjach dekoracji malarskich zastosowane zostały następujące techniki: technika mokrego fresku, technika krzemianowa (silikat) oraz technika sgraffita.

Technika fresku mokrego[22], zastosowana przy polichromiach kamienic przy Starym Rynku 66 i 39, jest znana od dawna, naukowcy wywodzą ją od malarstwa jaskiniowego, w XV wieku zyskała powszechne uznanie i miano królowej technik malarskich. Szczególnie przyjęła się we Włoszech. Spoiwem w tej technice jest świeża zaprawa wapienna otrzymana z wapna gaszonego (wodorotlenek wapnia) i piasku. Wapno gaszone otrzymuję się z wapna palonego (tlenek wapniowy) zmieszanego z wodą według reakcji $CaO + H_2O = Ca(OH)_2$ i następnie dołowanego. Fresk wykonuje się na mokrym podłożu w systemie dniówkowym. Barwniki pochodzenia mineralnego odporne na alkaliczne działanie wapna, rozcieńczane w wodzie, wodzie wapiennej lub wodzie barytowej uzyskują spoiwo ze świeżej zaprawy, gdzie wapno gaszone pod wpływem dwutlenku węgla z powietrza przemienia się w krystaliczny węglan wapnia, która twardniejąc czyni je wodoodpornymi. To wiązanie ściśle łączy malowidło z zaprawą w warstwę krzemianu wapniowego. Trwałość fresk mokry zawdzięcza reakcji chemicznej i trwałości zaprawy. Na fresk mokry szkodliwie działają: zanieczyszczenia atmosferyczne(kwas węglowy i kwas siarkowy, wahania temperatury, oraz owady.

Technika krzemianowa[23] jest stosunkowo młoda, decydujące było poszukiwanie techniki przypominającej mokry fresk, odpornej na warunki atmosferyczne, zalecone przez króla Ludwika II Bawarskiego (1864–1886), ponieważ mokry fresk nie sprawdzał się w Bawarii. Szereg naukowców poczyniło poszukiwania w tej kwestii, jednak to Adolf Wilhelm Keim w 1878 roku opatentował wynalezione przez siebie farby krzemianowe z użyciem szkła wodnego i barwników mineralnych. Spoiwem jest szkło wodne, bezbarwna ciecz rozcieńczalna w wodzie,

22 W. Ślesiński, *Technika fresku mokrego, w: Techniki malarskie. Spoiwa mineralne,* Wydawnictwo Arkady, Warszawa 1983, s. 11–41.

23 Ibidem, *Technika krzemianowa,* s. 92–107.

połączenie krzemu z sodem lub potasem. Są to krzemian sodu [$Na_2O_nSi_2$ (n = 3–5)], krzemian potasu (K_2SiO_3) oraz podwójne szkło wodne – mieszanina potasowego i sodowego szkła wodnego. Farby Keima wymagają w zaprawie dodatku cementu, farby wnikają w zaprawę i łączą się z jej składnikami kamieniejąc tworzą krzemienną skałę, nie tworzą one szczelnej błony, pory zaprawy nie zostają zamknięte przy wymianie wilgotności i powietrza co wpływa na trwałość polichromii. Farby Keima po zaschnięciu i chemicznej reakcji są odporne na wodę, trwałe zmiany atmosferyczne. Tworzą powłoki odporne na chemikalia(kwasy i ługi), rozpuszczalniki przemysłowe i spaliny, nie stanowią pożywki dla mikroorganizmów.

Farby silikatowe, zastosowane przy polichromii kamienicy przy ul. Paderewskiego 3, są odmianą farb krzemowych, jednokomponentową mieszaniną barwnika ze środkiem wiążącym, można je nabyć gotowe, są rozcieńczalne w wodzie i maluje się nimi na suchym podłożu.

W technice sgraffita[24] używa się podobnych zapraw i spoiwa jak w fresku mokrym, stosuje się zaprawę wapienną. Sgraffito nie jest dosłownie malarstwem, ale techniką dekoracyjną w której rysunek odgrywa decydującą rolę. Można powiedzieć, że jest to technika rysunkowa w wilgotnej zaprawie mineralnej. Porównuje się ją do drzeworytu, tylko w drzeworycie wypukłe linie i płaszczyzny są rysunkiem, a w sgrafficie wklęsłe powstałe z wydrapania pobiały lub wycięcia wilgotnej zaprawy. Sgraffito może być dwubarwne lub wielobarwna, sgraffito dwubarwne tworzy się przez sporządzenie narzutu wyrównawczego, położenie warstwy zaprawy barwionej i na niej pobiały wapiennej lub zaprawy bezbarwnej, a następnie wydrapuje się lub wycina rysunek odsłaniając spodnią warstwę. Sgraffito wielobarwne, zastosowane w polichromii kamienicy przy Starym Rynku 99, powstaje poprzez wycinanie w kilku warstwach nałożonej, wilgotnej, barwionej zaprawy. Pracuje się podobnie jak wykonując mokry fresk w systemie dniówkowym, pracując tylko na wilgotnej zaprawie. Na trwałość sgraffita wpływa stan podobrazia czyli muru ceglanego lub kamiennego. Szkodliwy wpływ mają także podobne czynniki jak przy mokrym fresku.

Wnioski

Zamiarem autora artykułu było zbadanie wpływu czasu i techniki wykonania na stan zachowania polichromii kamienic w tym konkretnym miejscu, na Starym Rynku w Poznaniu na podstawie prześledzenia trwałości polichromii na elewacjach kilku kamienic, z którymi autor był bezpośrednio związany poprzez projektowanie, wykonawstwo oraz działania naprawcze.

Po analizie przedziałów czasowych pomiędzy latami wykonania, a interwencjami naprawczymi i zaznajomieniu się z właściwościami użytych spoiw mineralnych: wapiennych fresku mokrego i sgraffita oraz krzemianowych (silikat) nasuwają się następujące wnioski.

1. Zastosowanie techniki fresku mokrego jest problematyczne i z powodu braku odporności na warunki atmosferyczne i zanieczyszczenie środowiska związanego z rozwojem współczesnej cywilizacji.
2. Zastosowanie techniki sgraffita z powodu użycia spoiwa wapiennego daje podobne do fresku mokrego słabe gwarancje trwałości i utrzymania dobrego stanu zachowania.
3. Zastosowanie techniki krzemianowej daje o wiele większe gwarancje utrzymania dobrego stanu zachowania z powodu swoich właściwości dające odporność na trwałe zmiany atmosferyczne, powstającej powłoki odpornej na chemikalia (kwasy i ługi), rozpuszczalniki przemysłowe i spaliny.
4. W odpowiednim czasie przeprowadzone konserwacje i restauracje polichromii znacznie przedłużają dobry stan ich zachowania. Dotyczy to szczególnie technik fresku mokrego i sgraffita.

Powstanie polichromii kamienic na Starym Rynku w Poznaniu uwarunkowane było specyficznymi wydarzeniami związanych z odbudową po zniszczeniach wojennych. W rezultacie powstały obiekty architektoniczne, które są krytykowane pod względem autentyczności, ale z powodu kryterium czasowego stają się zabytkami[25], są one dokumentami epoki, w której powstawały i powinny być jak najlepiej zachowane zarówno w zakresie architektury jak i polichromii.

24 Ibidem, *Technika sgraffita*, s. 76–86.

25 G. Klause, *Próba nowego spojrzenia na problem odbudowy Starego Rynku*, w: *W cieniu ratuszowej wieży*, Kronika Miasta Poznania, 2003/2, Poznań 2003, s. 459.

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Retrospection: genesis and durability of post-war polychromes of tenement houses in the Old Market Square in Poznań

Abstract: The article presents the artist's and researcher's own artistic experiences related to the implementation of painting decorations of tenement houses at the Old Market Square in Poznań. These are the works created in 1986, 1994 and 1997.

The first project was a consequence of quite unexpected incorporation of the polychrome of the tenement houses at the Old Market Square in Poznań. It was about 30 years, after World War II, when the polychrome on the reconstructed tenement houses was created. There was a need to restore the painting decorations by Edmund Łubowski on a tenement house at 39 Stary Rynek and the sgraffito by Józef Flieger at 99 Stary Rynek. The situation was a consequence of such advanced destruction that it was impossible to renew the works. Due to the fact that the authors were then still alive, it was possible to consult the reconstruction process.

In 1994, the author received another proposal to make, according to his own design, a new painting decoration, made in the wet fresco technique, on a tenement house at 66 Stary Rynek. Later, in 2010, the restoration and conservation work was conducted in consultation with the author.

In 1997, a painting decoration was designed on the tenement house at 3 Paderewskiego Street, close to the urban interior of the Old Market Square. Based on the project, painting decorations were made in the silicate technique.

The artist's experience, drawn from the aforementioned works, has become the subject of qualitative research that correlates the passage of time and the type of wall painting techniques used as well as other technical conditions influencing the state of preservation of the polychrome with artistic issues.

Keywords: architecture, reconstruction, polychromy, Old Market Square in Poznań, mineral binders, state of preservation, conservation, restoration

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The importance of creating a cultural park within the historical centre of Zamość. Good practices. The cultural park is not the Zamość Park

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Abstract: Zamość is a town of remarkable urban landscape and architecture. The first urban idea on the masterpiece of Italian-style fortification from the late 16th century evolved gradually throughout centuries until 19th century. The plan and examples of architectural pearls are stylistically homogenous. The fortifications underwent many transformations and 21st century brought some outstanding projects for the reconstruction of substantial amount of fortress elements. The Zamość Park retained the green parts of fortifications which added to its undoubted picturesqueness. The Zamość unique and valuable urban layout and architectural splendor call for creating suitable preservation and clear rules of management. Such tools can be achieved by forming a cultural park – mentioned in the Act on the Protection and Care of Monuments as one of the ways of protection of urban and architectural monuments. The term should not be confused with a notion of a park as an arrangement, composition of greenery on a particular terrain.

Keywords: the Zamość Park, Strategic Landscape, Zamość, cultural park

Historical overview of the Zamość Park

Tadeusz Tołwiński once said: Planning takes place on a two-dimensional piece of paper in order to fulfil economic, technical, utilitarian and other needs. The composition of landscape proceeds further, as it fills in the 2D layout with a meticulous arrangement of shapes and spaces which create a remarkable scene, experienced in three dimensions. This is how the architecture of landscape evolves, out of background greenery, masterpieces of engineering, various buildings, cities, gardens and cultivated fields"[1] (translation by the author).

Such understanding of a city landscape matches the idea about the Zamość Park space because that area is shaped by dynamically changing terrain which allows for various views.

The Zamość Park constitutes one of the most important and attractive recreational spaces in the Town. Its attractiveness is directly connected with its location. It stretches on the area that used to be a part of the Zamość fortification elements dating back to the 19th century. Within the park, there are the remnants of the former Bastion IV, the Old Lublin Gate, the fragments of the moat, the curtain wall, the ravelin, the counterguard (Fig. 1b), the casemate, (Fig. 5). The Park belongs to the list of about 10 000 historical gardens in Poland.[2]

1 Przegon W., "Gospodarowanie krajobrazem w historycznym centrum Zamościa", Czasopismo Techniczne, Wydawnictwo Politechniki Krakowskiej, z. 7-A/ 2008, ISSN 0011–4561, ISSN 1897–6271, p. 89.

2 Pudelska K., Rojek K., "Zmiany w strukturze drzewostanu w XIX wiecznym Parku w Czesławicach", Teka Kom. Arch. Urb. Stud. Krajobr. – OL PAN, 2013, IX/3, 56–63.

Unfortunately, only some of them survived in their original, fullest form. The author of the project (the project entitled "Myśl" – eng. "Thought") for the Zamość Park was Walerian Kronenberg who designed over 300 public service parks, court and palace gardens in Poland, as well as current Ukraine, Bielarus, Latvia and Crimea.[3]

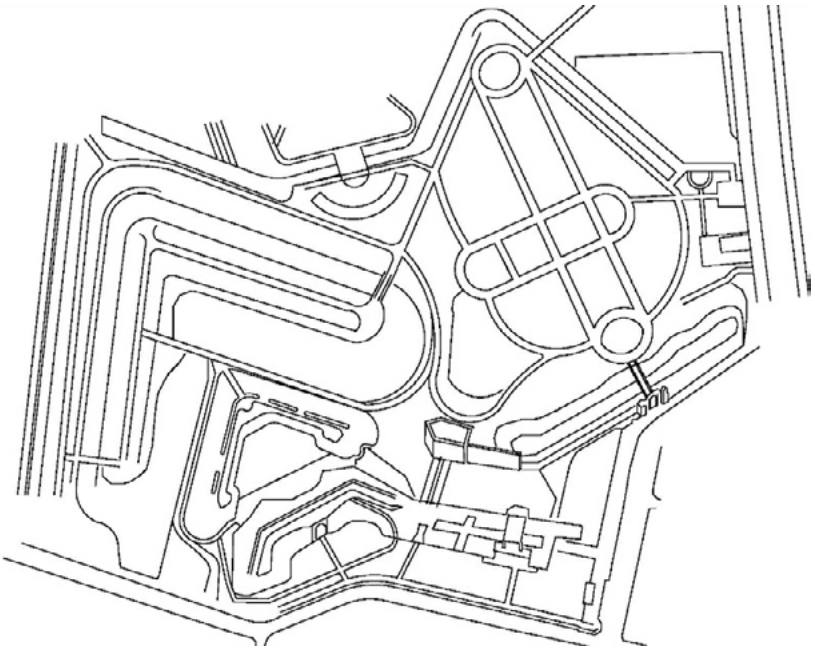

Fig. 1a. The Zamość Park outline; Source: author's drawing.

Fig. 1b. The Zamość Park, the view from the area of the counterguard towards the pond area. Source: Courtesy of Archiwum Państwowe w Zamościu (the State Archives in Zamość).

The Park was designed in a modernist style. The era of modernism, going to the beginning of the XX century, brought a rampant flow of urbanism connected, among others, to tendencies of shifting towards industry. Gardens, parks were to bring repose, relaxation and open, green space.

The Park was created between 1919 and 1926 although the attempts to create some local, recreational space were made in 1903 and 1910. In the very first years of its building process, the local authorities decided to organize a cow pasture within the newly stated boundaries. The executive manager of the works was an engineer Edward Kranz. In accordance with the Kronenberg's idea, there were planted native species of trees and

3 Walerian Kronenberg – Wikipedia, wolna encyklopedia, access: 16.03.2021.

decorative shrubs among them there were maple trees, lime trees, ashes, chestnuts, spruce trees, and shrubs such as: lilac, jasmine, forsythia, guelder rose[4] (Fig. 3). The work was carried out by the unemployed. Originally, the Park was named after the Great Chancellor Jan Zamoyski which was inscribed on the entrance gate to the Park. The Zamość Park could be divided into two main compositional parts: the one that is more natural in a sense that it follows the structure of the former fortress elements (Fig. 6), and the other organized in two representational directions of parallel paths positioned at a right angle one to another. This more organized one encompasses geometrical, clear, fairly predictable, static, repetitive divisions of space (Fig. 2).

The picturesqueness of the place results not only from the topography of the terrain but also from the views on key architectural structures which are important symbolically and from the engineering standpoint. The Old Lubelska Gate was built between 1581–1588 but at the beginning of XVII century it was locked down, in commemoration of the entrance to the Fortress of Stefan Batory and taken hostage, after the Battle at Byczyna, archduke Maksymilian Habsburg. It was reopened in 1790 but ended up being closed again in 1820'. After the liquidation of the fortress in 1866 it was partially demolished and rebuilt. Nowadays, it plays and important role in the Zamość Park landscape. The Lublin Gate adds to the picturesqueness of the Park and serves as one of iconic, orientation points in the area.

Fig. 2. The Zamość Park, The view towards the north; around 1927. Source: Courtesy of Archiwum Państwowe w Zamościu (the State Archives in Zamość), the photograph given to the Archives by Janina Kalińska from Warsaw.

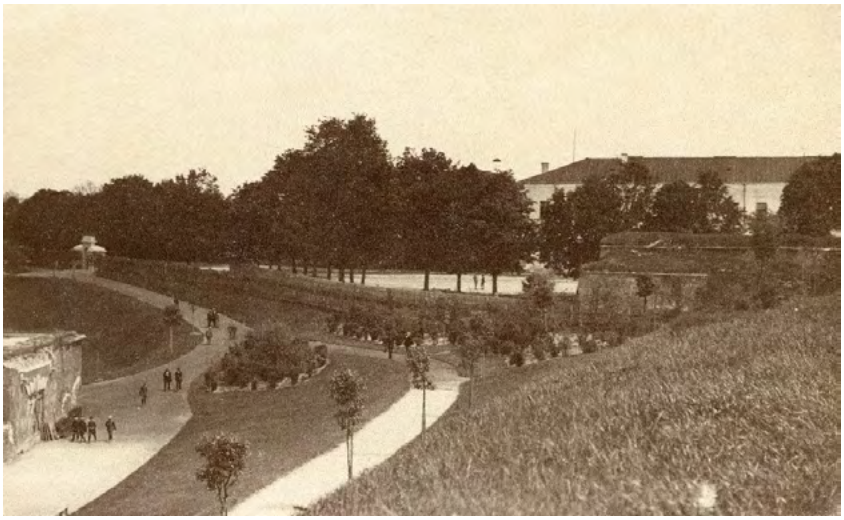

Fig. 3. The Zamość Park, The view towards the Zamość Academy; around 1926. Source: Courtesy of Archiwum Państwowe w Zamościu (the State Archives in Zamość), the photograph given to the Archives by Janina Kalińska from Warsaw.

4 Zamościopedia – PARK MIEJSKI (zamosciopedia.pl); access: 16.03.2021.

Fig. 4. The Zamość Park, one of the examples of forms of recreation present in the first years of the Park; around 1936. Source: Courtesy of Archiwum Państwowe w Zamościu (the State Archives in Zamość), the photograph given to the Archives by Waldemar Hantz.

Fig. 5. A contemporary view towards northern east, The Zamość Park 2021. Source: author's photograph.

Fig. 6. A contemporary view towards north, The Zamość Park 2021. Source: author's photograph.

One of the forms of protection of historical sight and monuments is the concept of a cultural park, as mentioned in the Act of the Protection and Care of Monuments.[5]

Problems and tools for the protection of the Strategic Landscape present in the Park area

The Park performs major role in preserving, what professor Janusz Bogdanowski called "krajobraz warowny" (eng. "Strategic Landscape")[6]. Cultural park, as the most adequate and successful ways of protecting a historical centre of Zamość, should be created and regarded as a priority for local government in their targets of financing and decision – making. Integrated forms of protection allow for establishing consistent, clear set of rules for a given area. Complete approach to the preservation of cultural heritage of the Zamość fortifications area, including the Park, might help to eliminate any incongruities between various documents describing the issue. Zamość might follow into the footsteps of Cracow whose authorities decided to form Cultural Park for the City of Cracow (2010) which safeguards exposition, cultural heritage, historical urban layout of Cracow within the boundaries of Planty and the Wawel Hill. The idea of an integrated approach to some part of the city enables the authorities to regulate, among others, the organization of public events, meetings. In December 2019, the President of Cracow appointed an Integrated Centre for the Management of the Cracow Heritage (Zintegrowane Centrum Zarządzania Dziedzictwem Krakowa) whose main tasks are: the management of the cultural landscape and cultural heritage resources as well as the supervision of the implementation of the UNESCO recommendations. The Cultural Park could finally set overall rules for the aesthetical outlook of public space and cultural landscape. It encompassed the standards for the shapes of advertisements, information posts, the forms of rooftops, divisions on elevations, the rules for street commerce, vending places and restaurant open-air gardens. The owners of buildings, business people operating within that terrain were given six months to adapt to the new laws and regulations. As a result, the old, historical center keeps its original, unique beauty. Restrictions on excessive commerce practices which may negatively influence the architectural form of buildings help or tarnish their proper exposition. The area is also preserved as far the historical cityscape, observation points and compositional axes are concerned together with the protection of the views to some other valuable parts of the city seen from the terrain of the Cultural Park. Together with the protection of an urban layout, comes special care for single examples of architecture, the aim to present them in the most attractive way so that they build local identity.

Another positive example of the formation of rules for a cultural park comes from Poznań (local council's Resolution: "Park Kulturowy Stare Miasto w Poznaniu", eng. A Cultural Park of the Old City of Poznań). Among many other materials, the City established a very practical, clearly written brochure on the introduction of advertisement carriers into the city landscape.[7]

Strategic Landscape consists not only of fortification elements but also of communication paths, forms of greenery, water reservoir and channels or observation points. As Myczkowski points in the article about the reasons for the formation of the cultural park of Zamość, the public spaces of the Town should be preserved as wholes (for example, streets, piazzas with their adjacent building development). Such approach is justified by the Outstanding Universal Value factor which pertains to Zamość characteristics on the basis of its inclusion in the UNESCO World Heritage List. Another form of protection of the cultural landscape is created locally. Main prerogatives of protecting the unique landscape of historical Zamość are stipulated in local spatial development plans.[8]

The problem about the preservation and creative evolution of historical areas of Zamość is that the local documents, analysis and programs are sometimes insufficient. Educational offer about the importance of

5 Kałamucka W., "Parki kulturowe w Województwie Lubelskim" Zarządzanie Krajobrazem Kulturowym, In the Lubelskie Voivodship there are 3526 immovable monuments, 37 of them being the protected historical areas. It gives ninth place in Poland.

6 Myczkowski Z., "Krajobraz warowny Twierdzy Zamość w kontekście idei tożsamości miejsca i jej składników", "Strategic landscape of Zamość fortress in context of idea of identity of place and its parameters.", TEKA KOMISJI URBANISTYKI I ARCHITEKTURY PAN ODDZIAŁ W KRAKOWIE TOM XLIII (2015) PL ISSN 0079–3450 s. 113–125 PL eISSN 2450-0038.

7 "Park Kulturowy. Czyli jak zadbać o estetykę Starego Miasta. park kulturowy_broszura (1).pdf.

8 Old City of Zamość – UNESCO World Heritage Centre; access: 17.03.2021.

preserving cultural landscape of the Town could focus on younger citizens attending schools. The Town might cooperate with schools in that matter so as to explain the value of the Zamość landscape. Programs, written in simple, encouraging language could be turned to common citizens.

Recreational function of the Zamość Park

From the very first years of its functioning, the Park was a place for recreational, leisure activities for the citizens. Until 1924, some pieces of street furniture emerged, people enjoyed time in boats and kayaks (Fig. 4). There were also a patisserie, a shooting range, sports court the so-called "little stadium" where, during summer time, dancing meetings and sports events, scouts bonfires, open-air theatrical performances or cinema evening shows took place. Winter also brimmed with various leisure activities, such as ice skating on ponds. Some of the information taken from.[9]

In the history of the Park, there were also some events connected with the Zamość Days when "The Venetian Night" was organized with some lampions, fires, lights. Another occasion was a folk party with a parade of boats and Bengal fires. The ponds were stuck with fish, there were also swans, wild ducks, squirrels, occasionally foxes.

The Zamość Park is still insufficiently used as a location for historical and cultural promotion of the town. Summer seasons bring the most frequent events happening in this mode although the greatest concentration of such events still takes place on the Great Market Square, the Solny and the Wodny Markets.

Conclusion

The Zamość Park functions as a buffer zone enabling citizens and tourists to admire fortification elements while walking along them, taking different viewpoints in the atmosphere of coziness and calming effects of surrounding greenery. Every now and then there are information points connected to the former fortification system present around the Park.

Even though the relicts of the fortress are covered with green, the parts of the system "retain its original layout".[10]

In the SWOT analysis carried out in the "Municipal program for the protection and preservation of historical monuments of Zamość 2020"[11] among weaknesses there were mentioned: too intensive usage of the Great Market Square for entertainment events; the lack of municipal coordinator/ professional specializing in the preservation and surveillance of the works on the historical heritage of Zamość; insufficient number of information carriers present in the town's public spaces. The local authorities could instigate tighter cooperation with private owners of some businesses run around the area of the historical centre of Zamość. The renewal of the tradition of winter ice skating in the Park would be a great option for taking the ice rink away from the Great Market Square.

Local authorities should focus on creating the area of a cultural park within the boundaries of the historical Zamość which is included in the UNESCO World Heritage List. The concept of the cultural park caters for the highest, the most concise levels of conservatory protection. Among the rules there should be:

- The value of an architectural outlook of monuments, the proportions of elements on elevations, juxtaposition and subtlety of the colours used should not be distorted by a random placement of advertisements.
- Organizational characteristics of open-air events, festivals together with pieces of information given on those events.
- Stylistic shape of open door restaurant areas.
- Stricter rules concerning the organization of public space in terms of wayfinding criteria.

9 Sawa B., "Dzieje zamojskiego parku", Zamojski Kwartalnik Kulturalny, 2004 (1–2) Biblioteka Cyfrowa dLibra – Zamojski Kwartalnik Kulturalny, 2004, Nr 1–2 (78–79) (http://zamosc.pl).

10 Old City of Zamość – UNESCO World Heritage Centre; access: 17.03.2021.

11 Szmygin B., Fortuna-Marek A., Siwek A., "Gminny program opieki nad zabytkami miasta Zamościa", Strategiczny dokument samorządu w ochronie zabytków, Lublin 2020, *siwek_et-al_gminny_program_opieki_nad_zabytkami_miasta_zamoscia_2020.pdf; access: 19.03.2021.

- Restrictions imposed on the types of selling methods and the limitations on the list of products to be promoted.
- Size, layout, selected types of materials, location in space of tourist information carriers must be carefully prepared based on universal design criteria as well as preserved, unique surrounding of a place.

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Flat pneumatic elements and their potential use in the construction of dwelling facilities within emergency housing systems

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Abstract: As part of this study, experimental and theoretical investigations into the strength and stiffness of flat pneumatic elements to be used in lightweight dwelling structures, enabling the quick assembly of the latter, were undertaken.

On the basis of the experimentally and theoretically determined parameters of the elements it will be possible to design configurations of spatial pneumatic structures.

In particular, the following were devised and carried out:

- a theoretical assessment of the load capacity and stiffness of selected pneumatic elements depending on their dimensions, internal pressure and fixing and support conditions,
- an experimental verification of the obtained results.

This study has an exploratory character and constitutes the basis for the design and implementation of original technical, constructional and architectural solutions relating to the application of spatial pneumatic structures in the emergency system.

It should be mentioned that in the known literature on the subject there is no theoretical basis for designing structures whose principal member is a flat pneumatic element.

In the construction industry such structures have not been used so far. An exemplary solution of the spatial dwelling structure has been patented under the name *Obiekt mieszkalny* (*Dwelling facility*), (patent no. 131 528, of 18.04.1988).

The work is innovative. Apart from the military applications in the USA, mentioned by the author, studies on the subject are unknown. All the more so, it seems that the research is worth continuing as pneumatic components can have many civilian and military applications. Their use in the construction industry would prevent the housing problem in the case of natural disasters or in other more dramatic events.

Keywords: pneumatic structures, spatial pneumatic structure, dwelling facilities

Subject and aim of the study

As part of this study, experimental and theoretical investigations into the strength and stiffness of flat pneumatic elements to be used in lightweight dwelling structures, enabling the quick assembly of the latter, were undertaken. A calculation method and experimental tests for assessing the load-carrying capacity and strength of such elements as the structural components of pneumatic structures need to be developed. The experimentally and theoretically determined parameters of the elements will form the basis for designing configurations of spatial pneumatic structures. The following were devised and carried out:

- a theoretical assessment of the load capacity and stiffness of selected pneumatic elements depending on their dimensions, internal pressure and fixing and support conditions;
- an experimental verification of the obtained results.

In the next stage of this project a prototype or model of the spatial pneumatic structure as a dwelling module is to be made, but first such a system needs to be designed, which comprises:

- formulating a theoretical basis for structural pneumatic components for spatial dwelling modules;
- drawing up technical and technological specifications for manufacturing structural pneumatic components;
- specifying ways of fixing, joining and supporting such components to create spatial dwelling modules out of them;
- specifying conditions and methods for designing function, form and technical solutions within the Emergency Housing Construction System (EHCS); an example of such a solution has been patented under the name *Obiekt mieszkalny (Dwelling facility)* at the Patent Office of the Republic of Poland [3].

This study has an exploratory character and constitutes the basis for the design and implementation of original technical, constructional and architectural solutions relating to the application of spatial pneumatic structures in the Emergency Housing Construction System (EHCS) which is the ultimate objective.

The are several reasons, mainly functional, for undertaking this project since among the existing construction systems there is no system which would make it possible to create such maximally high-standard dwelling conditions in a maximally short time as the planned EHCS based on flat pneumatic elements (pneumatic plates) is capable of creating.

The system was called EHCS with regard to the conditions in which it is to be used. It is intended for erecting dwelling facilities in areas lacking technical infrastructure, for workers carrying out temporary construction/geological work and for explorers in the natural environment. It can be used in the construction of seasonal tourist and sports facilities and also in areas ravaged by war or natural disasters.

EHCS will be based on the pneumatic plate – a basic structural component used to create dwelling modules in any spatial form.

Owing to the light weight of EHCS and to the fact that it can be transported using various means of transport (land, water and air transport), it will be possible to immediately fill in any missing parts in the housing structure in any terrain and subsurface conditions. Prefabricated EHCS dwelling elements will be stored in and transported directly from fabrication plants or regional, national or international banks of EHCS dwellings.

The wall and floor components of the dwelling modules are plates made of a flexible material, stiffened with compressed air from the inside. The plates are joined together by means of flexible connectors, to form multispace dwelling modules having cuboid shapes or other functionally or structurally justified shapes.

The sizes of dwellings in EHCS vary, being a multiplication of the adopted modular system. Each of the dwellings is equipped with utility connections. The wall and floor plates are made of flexible shells characterized by proper elasticity, joined together by a system of tendons and a layer of a porous material constituting a compressed gas holder.

The advantages of this type of construction are:

- high structural and functional flexibility, whereby dwellings can be adjusted to the needs of the family and a particular group of occupants;
- quick assembly and disassembly in any terrain;
- light weight – the weight of the structure per 1m^2 of dwelling space is 20–40 times lighter than that of a conventionally built building;
- owing to the small dimensions of the uninflated dwelling modules (stored and transported in the form of packets) and their light weight, many means of transport, including air transport in hardly accessible areas, can be used;
- immediate usability thanks to the system of pneumatic furniture, plastic film or organic glass in window openings and the fact that each dwelling is equipped with a kitchen block and a bathroom block, forming a functional and structural whole with the dwelling;
- the maximum adherence to the principle of the inviolability of the natural terrain and environment owing to the temporary character of the development and its peculiar features, such as: no earthworks, and minimum engineering and site enabling works.

In order to implement the EHCS concept the stability and structural properties of the pneumatic plate (walls and floors) and linear elements (columns and beams) need to be theoretically determined and the obtained theoretical relationships must be experimentally verified.

Moreover, possible ways of joining the components as well as the tightness and thermal insulating power of the latter must be determined.

The theoretically and experimentally determined pneumatic element sizes and parameters will provide the basis for designing pneumatic elements and spatial pneumatic structures.

It should be mentioned that in the known literature on the subject there is no theoretical basis for designing structures whose principal component is a flat pneumatic element.

However, it is known that pneumatic plates have been used in the US military aviation industry to build a manned plane whose all structural components (airfoils, stabilizers, the fuselage) are made of flat inflatable elements (pneumatic plates).

In the construction industry such structures have not been used so far (of course, except for linear, nonflat elements, such as arches, ribs, etc.).

The test results presented further in this paper show that the tested element (the plate) resists considerable buckling forces[1], which augurs well for its use for the structural components of EHCS.

Bending test results indicate that within the range of the internal pressures used in the experiment the plate has a very low bending stiffness. This means that in order to increase the plate's bending stiffness one must increase the internal pressure or the cross section.

It follows from the above findings that the flat pneumatic structural components can be used for the load-bearing walls and floors of EHCS dwelling modules, provided that the internal pressures and cross sections of the components are properly matched.

Pneumatic structural components

Theoretical basis for calculating compressive, bending and buckling stiffness of pneumatic structural components

A pneumatic element, in the form of a plate, subjected to internal pressure is considered. The shape and dimensions of the element are shown in figure 1. The element is made of rubberized fabric. Owing to the presence of the fabric in the element's shell the latter has anisotropic properties. The anisotropy comes down to orthotropy whose principal directions coincide with the orientation of the fibres. The directions of the anisotropy are shown in fig. 1.

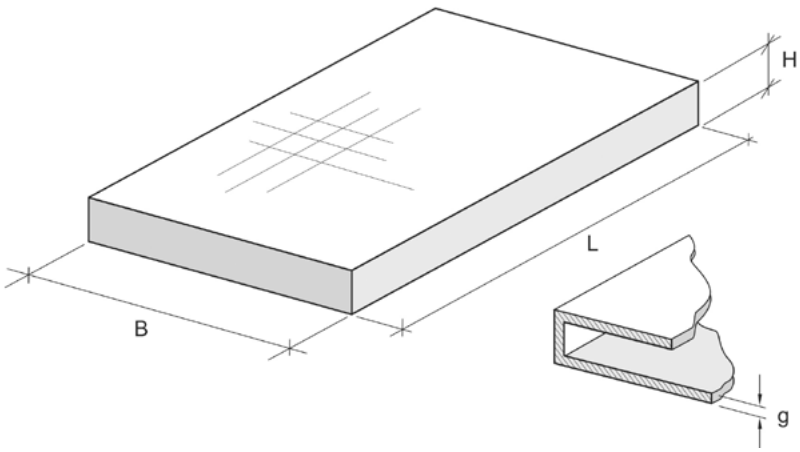

Fig. 1. Dimensions of pneumatic structural component and directions of plate anisotropy. Source: own research.

1 For example: a the internal pressure of 8 kPa the critical force in the tested component exceeds 230 N, whereas at the pressure of 20 kPa the force increases to 922 N.

In further considerations, when deriving theoretical relationships for the plate, the following simplifying assumptions are made:

- the material of the pneumatic element carries solely tensile stresses;
- a planar state of stress, whose principal directions coincide with the axes of symmetry of the structural component, prevails in the plate;
- the anisotropy of the two-phase material, i.e. rubber reinforced with fabric, was omitted, assuming mechanical properties averaged across shell thickness *g*.

Determination of stresses in plate subjected to internal pressure

A planar state of stress, whose distribution is shown in figure 2, prevails in the plate.

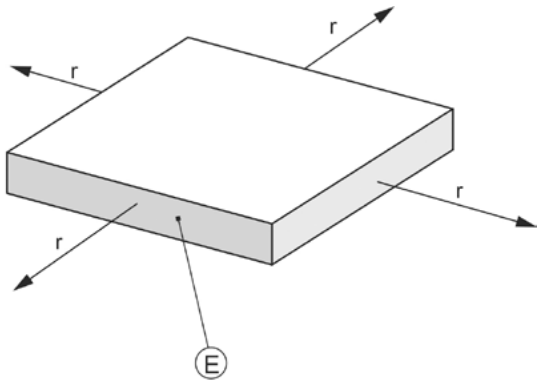

Fig. 2. Components of stress state in plate (E – component of plate). Source: own research.

The stresses amount to:

$$\sigma_1 = \frac{F}{A_1} = \frac{p \cdot B \cdot H}{\left(2 \cdot B + 2 \cdot H\right)} \tag{1}$$

$$\sigma_2 = \frac{F}{A_2} = \frac{p \cdot L \cdot H}{\left(2 \cdot L + 2 \cdot H\right)} \tag{2}$$

where: p – the internal pressure in the plate, L, H, B, g – the plate dimensions as specified in figure 1.

The safety condition for the plate's material will be determined on the basis of Huber's yield criterion and strength hypothesis:

$$\sigma_{red(H)} = \sqrt{\sigma_1^{\,2} - \sigma_1 \cdot \sigma_2 + \sigma_2^{\,2}} \le k_r \tag{3}$$

Pneumatic element under compression(without buckling)

The compression loading scheme for the plate is shown in figure 3. For the pneumatic element subjected to compression, but protected against buckling, the maximum compressive force was calculated assuming that the shell carried solely tensile stresses which could reach the limit value of 0, i.e.

$$\sigma_p + \sigma_F = 0 \tag{4}$$

where: σ_p – the stress in the shell generated by pressure p, σ_F – the stress in the shell generated by compressive force F_c.

One gets the maximum value of the compressive force from condition (4):

$$F_c = p \cdot B \cdot H \tag{5}$$

where: p – the internal pressure in the plate, B – the width of the plate, H – the thickness of the plate.

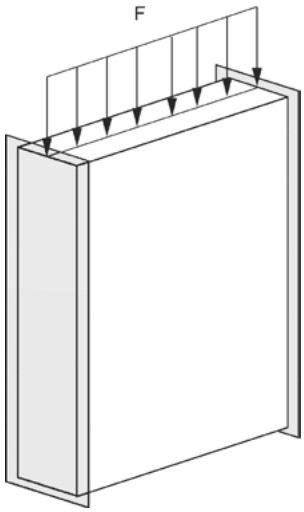

Fig. 3. Compression loading scheme for pneumatic component. Source: own research.

Pneumatic element under bending

The bending loading scheme for the pneumatic element is shown in figure 4.

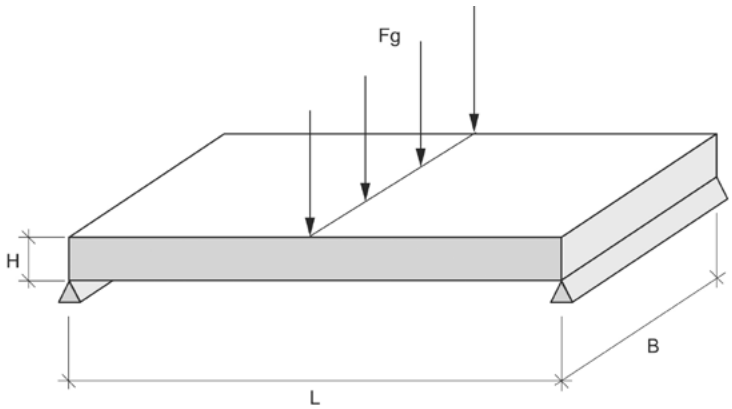

Fig. 4. Bending loading scheme for pneumatic element. Source: own research.

The following equation was used to calculate deflections:

$$f = \frac{F_g \cdot L^3}{48 \cdot EJ_z} \tag{6}$$

where: F_g – the bending force, EJ_z – internal pressure-dependent bending stiffness based on measurements, f – the maximum absolute deflection.

The unknown and difficult to determine equivalent stiffness EJ_z resulting from internal pressure can be calculated from the measured deflections. For this purpose we shall use relation (6) in the form:

$$EJ_z = \frac{F_g \cdot L^3}{48 \cdot f} \tag{6a}$$

Buckling. It is further assumed that the pneumatic component is linear-elastic. Thanks to this assumption the critical force which causes buckling can be calculated from Euler's relation:

$$F_k = \frac{\pi^2 \cdot EJ_z}{(\beta \cdot L)^2} \tag{7}$$

where: EJ_z – the equivalent bending stiffness, β – a coefficient dependent on the way of fixing the component.

The second moment of area of the pneumatic element's cross section is calculated on the basis of the dimensions given in figure 5.

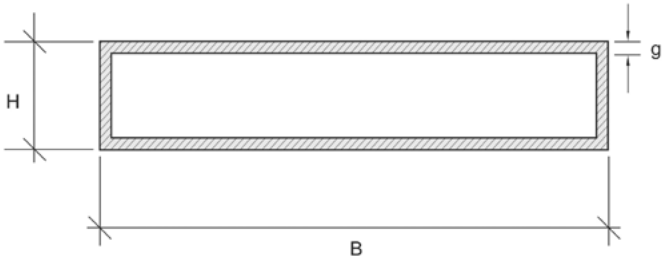

Fig. 5. Cross-sectional dimensions of pneumatic element. Source: own research.

Assuming that $H \ll B$, we shall omit the part of the second moment of area exhibited by the side walls of the element with height H. Under this assumption we get:

$$J_z \cong 2 \cdot B \cdot g \cdot \left(\frac{H}{2}\right)^2 = \frac{B \cdot g \cdot H^2}{2} \tag{8}$$

The minimum radius of gyration of the cross section is:

$$i_z = \sqrt{\frac{J_z}{A}} = \sqrt{\frac{B \cdot g \cdot H^2}{4 \cdot B \cdot g}} = \frac{H}{2} \tag{9}$$

Experimental tests

Pneumatic element. Experimental tests were carried out on a pneumatic element in the form of a rectangular prism. A mattress with flat walls was selected for the tests.

Measuring equipment. The measuring setup consisted of:

- a loading system,
- an air-compressor with maximum pressure p = 5 [MPa],
- a pressure gauge with the high measurement resolution of 0–0.05 [MPa]

The loading system was specially designed and built for the buckling testing of pneumatic elements. The system is shown in figure 10. The system enables the compression of a pneumatic element for the two ways of fixing its ends, shown in figure 6. Parts of the loading system were used as supports for measurements under bending.

Table 1. Results of measurements of pneumatic elements subjected to bending

No.	Measurement No.	Pressure p [kPa]	F [N]	f [m]	f_{cer} [m]	EJ_z [Nm^2]	$E \cdot J_{z(sr)}$ [Nm^2]	E [MPa]	E_{sr} [MPa]
1	1	8	70	0.08		50.02			
2	2	8	70	0.08	0.078	50.02	51.1	20	
3	3	8	70	0.075		53.3			
4	1	8	100	0.125		45.7			19
5	2	8	100	0.120	0.125	47.6	45.8	18	
6	3	8	100	0.130		44.0			
7	1	11.5	70	0.04		100			
8	2	11.5	70	0.035	0.04	114	100.1	39.1	
9	3	11.5	70	0.045		88.9			
10	1	11.5	100	0.075		76.2			
11	2	11.5	100	0.078	0.075	73.3	75.9	30.0	32.1
12	3	11.5	100	0.073		78.3			
13	1	11.5	150	0.125		68.6			
14	2	11.5	150	0.123	0.123	69.7	68.6	27.0	
15	3	11.5	150	0.127		67.5			
16	1	15	70	0.030		133.0			
17	2	15	70	0.030	0.030	133.0	134.7	52.7	
18	3	15	70	0.029		136.0			
19	1	15	100	0.048		120.3			
20	2	15	100	0.046	0.047	124.3	121.2	47.4	47.0
21	3	15	100	0.048		112.1			
22	1	15	150	0.086		102.3			
23	2	15	150	0.084	0.085	105.7	104.2	41.0	
24	3	15	150	0.085		104.5			
25	1	20	70	0.019		210.6			
26	2	20	70	0.018	0.019	222.3	214.5	84.4	
27	3	20	70	0.019		210.6			
28	1	20	100	0.032		178.6			
29	2	20	100	0.030	0.032	190.5	180.8	71.2	70.4
30	3	20	100	0.033		173.2			
31	1	20	150	0.065		132.0			
32	2	20	150	0.060	0.061	143.0	141.0	55.5	
33	3	20	150	0.058		147.8			

Measurement programme. The measurement programme covered measurements of the maximum absolute deflection under bending for the following pressures in the shell: 8, 11.5, 15 and 20 [kPa]. For each of the pressures the maximum absolute deflection was measured under the following loads (applied in the middle of the element length): 70, 100 and 150 [N]. Thanks to this measurement programme the effect of the internal pressure on the bending stiffness of the element, and the linearity of the deflections as a function of the load were assessed. The measurement programme for buckling included tests of the stability of the shell element for the three ways of fixing the shell's ends, shown in figure 6. The programme was carried out in the loading device.

No experiment is needed for the case of element compression (without buckling) since the maximum compressive force with which the pneumatic element can be loaded is calculated from equation 4. Also no experiment is needed to determine the stresses in the shell since their values can be theoretically determined. The stress intensity level in the shell material was not taken into account in further considerations since the adhesive bonds were the weakest elements. The experimental pressures were such that the shell was considerably stiff without losing its air tightness.

Bending. Shell bending strains were measured to experimentally determine the bending stiffness of the component and the longitudinal modulus of elasticity of the material depending on the pressure.

The measured maximum absolute deflections under bending are presented in table 1, which also contains values of mean equivalent bending stiffness $E \cdot J_{z(sr)}$ for different pressures and elasticity modulus (E_{sr}) values obtained from this experiment, also depending on the pressure.

Buckling. Critical buckling forces were measured for three ways of fixing the ends of the pneumatic element. The fixing cases are shown in figure 6.

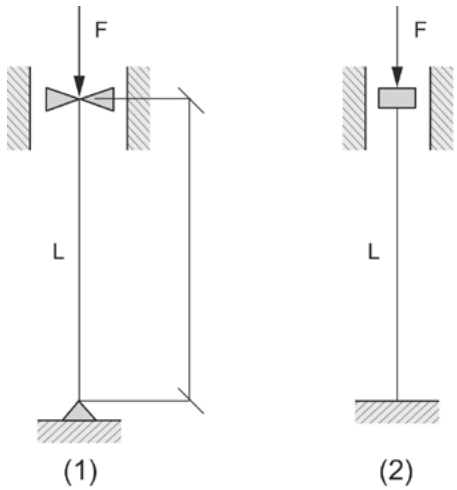

Fig. 6. Ways of fixing element ends, Source: own research

The tests were carried out at different internal pressure values. Similarly as for bending, the following internal pressure values were adopted: 8, 11.5, 15 and 20 [kPa]. The measurement results are presented in table 2.

On the basis of the results given in table 1a graph of $E \cdot J_{z(sr)}$ versus internal pressure p was drawn. The graph is shown in figure 7.

Table 2. Results of measurements of critical force at pneumatic component buckling

No.	Fixing case	β [kPa]	Pressure p [kPa]	Critical force F_{kr} [N]	Mean critical force $F_{kr(sr)}$ [N]
1	1		8	240	
2	1		8	226	235.7
3	1		8	235	
4	1		11.5	410	
5	1	1.0	11.5	390	387
6	1		11.5	360	
7	1		15	660	
8	1		15	620	617
9	1		15	572	
10	1		20	980	
11	1		20	925	922
12	1		20	862	
13	2		8	556	
14	2		8	450	476
15	2		8	423	
16	2		11.5	860	
17	2		11.5	800	790
18	2		11.5	710	

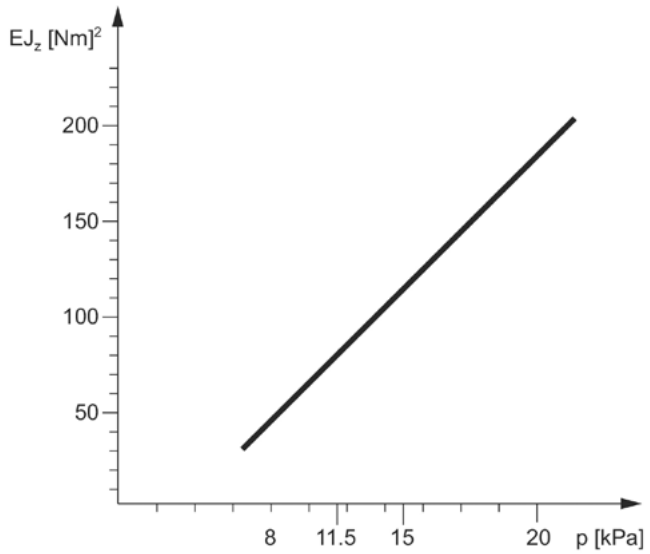

Fig. 7. Bending stiffness versus pneumatic element internal pressure. Source: own research.

The relationship between deflections and the loading force is shown in figure 8.

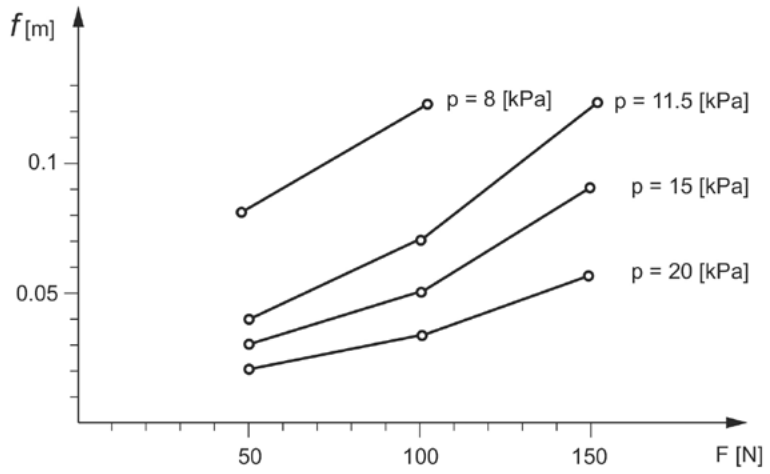

Fig. 8. Relationship between pneumatic element deflections and loading force at bending. Source: own research.

It appears from table 2 that the full range of buckling loads was implemented only for the two-hinged fixing. In the case of the other ways of fixing, the loading programme could not be implemented due to the too low internal pressures, whereby the element would deform as a result of compression before buckling occurred. For this reason only one graph illustrating the relationship between the critical force and internal pressure was drawn. The graph, based on table 2, for the first way of fixing the element's ends is shown in figure 9.

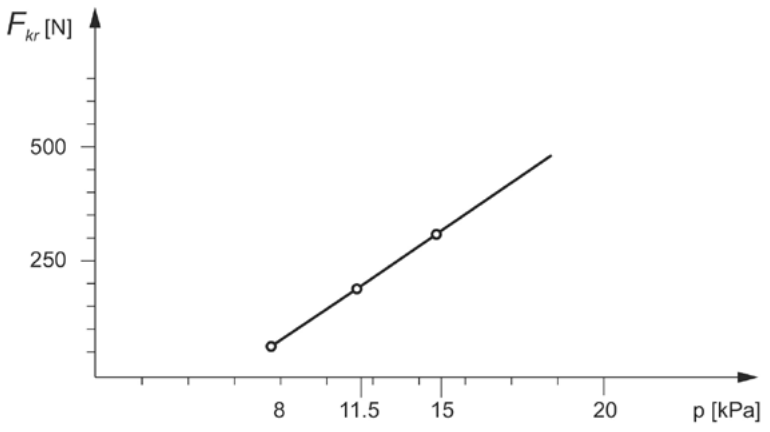

Fig. 9. Critical force versus pressure p (acc. to Euler) for two-hinged fixing. Source: own research.

Conclusions

- The bending stiffness of the pneumatic element is a linear function of internal pressure.
- In the case of the two-hinged fixing, the critical force is a linear function of pressure.

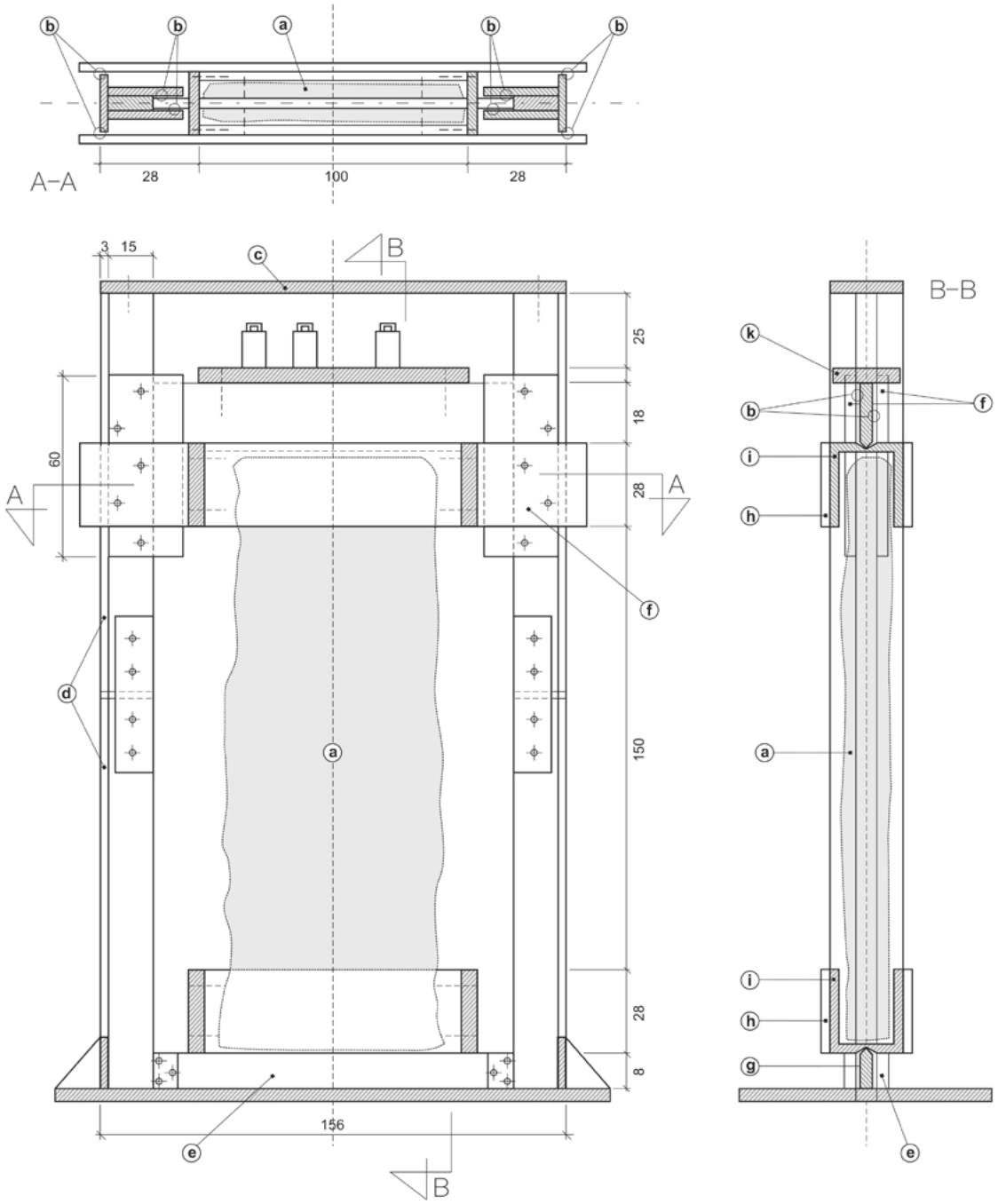

Fig. 10. Loading system (a – Inflatable mattress, b – Sliding gaps, c – Stiffener plank, d – Members joined together at mid height, e – Fixing element, f – Guides, g – Permanent element, h – Screwed-on plank, i – Box, k – Moving element). Source: own research.

Final conclusions

pt. 1. The applicability in the house building industry, of the spatial pneumatic structures whose principal structural component is a flat pneumatic element used to construct the load-bearing walls and floors of dwelling

modules, has been indicated and demonstrated considering the light weight of the spatial pneumatic structures, the ease and speed of their assembly and their computationally and experimentally proven advantageous load-bearing properties.
pt. 2. The critical force has been shown to be linearly dependent on the internal pressure in the flat pneumatic element, whereby its stiffness can be increased by increasing the cross section or the pressure. Under bending a similar dependence occurs between the bending stiffness and the internal pressure.
pt. 3. The relations presented in the theoretical part form the basis for developing models of various flat pneumatic elements (e.g. ribbings) and considering different ways of joining and supporting them.
pt. 4. It follows from pts 2 and 3 that it is necessary to build the components of the pneumatic structure, taking the results of this study into account, test them in the specified conditions and verify their dimensions and internal pressures. On this basis a prototype or model of the spatial pneumatic structure in the form of a dwelling module should be built.
pt. 5. On the basis of the results of this study (pt. 2) and the results obtained as specified in pt.4 it will be possible to develop computations and guidelines for designing spatial dwelling structures.

Recapitulation

1. It seems that the above research should be continued. As the principal directions of this research one can mention the following:
   1.1. The theoretical formulation of the model.
   1.2. The experimental testing of the model and finally, of the actual facility.
2. Moreover, from another point of view the research work can be divided into:
   2.1. Architectural work (concerning the architectural function and form of the dwelling facilities). Because of the different character of the pneumatic structures, in comparison with the currently used structures, one can consider, on the basis of the geometry of polyhedrons, the use of other than cuboidal, spatially-stable forms of the dwelling modules.
   2.2. Structural-constructional solutions (the formulation of assumptions concerning the geometric parameters of the structures).
   2.3. Materials strength investigations for different pneumatic plate models. The investigations should cover both structural calculations and experimental tests.
   2.4. Materials research (concerning the technology of manufacturing a proper material, and the testing of material properties).

Summing up, considering that no studies on this subject, which would cover both its scientific and utilitarian (the very wide range of potential applications) aspects, can be found in the literature, this research work should be continued.

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Płaskie elementy pneumatyczne i możliwość ich zastosowania w konstrukcji obiektów mieszkalnych awaryjnych systemów budownictwa

Streszczenie: Praca składa się z dwóch części. Pierwsza z nich jest opisowa, druga zaś jest sprawozdaniem z przeprowadzonych badań doświadczalnych. Generalnie, podjęto próbę określenia zakresu tematyki badawczej, której wynikiem byłoby określenie i wyznaczenie wszelkich parametrów dotyczących zarówno własności stosowanego materiału, jak i parametrów geometrycznych elementów konstrukcyjnych pneumatycznych obiektów mieszkalnych.

W szczególności opracowano i wykonano:

- teoretyczną ocenę nośności i sztywności wybranych elementów pneumatycznych w zależności od ich wymiarów, ciśnienia wewnętrznego, warunków zamocowania i podparcia,
- weryfikację doświadczalną otrzymanych wyników.

Przedstawiona praca ma charakter rozpoznawczy i stanowi podstawę do zaprojektowania i wdrożenia oryginalnych rozwiązań technicznych, konstrukcyjnych i architektonicznych w zakresie zastosowań przestrzennych struktur pneumatycznych do systemu awaryjnego.

Nadmienić trzeba, że w znanej literaturze przedmiotu brak podstaw teoretycznych do projektowania takich struktur, których zasadniczym elementem konstrukcyjnym jest płaski element pneumatyczny.

W budownictwie nie stosuje się dotychczas takich konstrukcji. Przykład rozwiązania przestrzennej struktury mieszkalnej został opatentowany pod nazwą „Obiekt mieszkalny", (patent nr 131 528, z dnia 18.04.1988).

Słowa kluczowe: lekkie konstrukcje nośne, konstrukcje pneumatyczne, przestrzenne struktury pneumatyczne, obiekty mieszkalne

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The technology that meets modern human needs – criteria of assessment of smart home system

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Abstract: The article is a summary of the research conducted for educational purposes with the participation of students from the University of Technology in Lublin in Poland, on the design and use of facilities created as smart home (SH). The increasing availability of smart building equipment systems is associated with their widespread use and reasonable price. New technologies, which are the result of scientific and technological progress, make it possible to use the devices to raise the standard of habitation and use of buildings. The creation of SH facilities nowadays is not only limited to single-family buildings. More and more often we observe smart multi-family and public utility buildings. At the same time, we are aware of the design of energy self-sufficient facilities, which allow us the freedom to build in undeveloped areas.

Keywords: new technologies, human needs, SH smart home system

Introduction

Modern houses are built to meet the needs of their users and respond to the times in which we live. The idea of SH is not a recent one; the appearance of the first home appliances was not at all related to their smart operation. Few people know that the origins of the system can be traced back to the 1970s, when, in order to improve production technology in industrial plants in the United States, a set of devices was implemented to increase the level of quality control. Production monitoring translated into economic results; therefore, the system was quickly applied in other sectors of the economy [9]. Eventually, after achieving positive results, it could also be used for the purposes of single-family housing.

It has been noticed that the devices can efficiently replace people in coordinating the work of various complicated systems. Due to independent digital and technological monitoring, many people have become interested in this technology. Creators of subsequent devices complementing the system wanted to attract the maximum number of customers aware of the benefits resulting from use of them. The acceptance of these devices by their users could be evidenced by a whole range of products that appeared on the market known by the common name SH. Their price very often did not compensate for the benefits. The next stage of development was the creation of particular groups of devices, starting from simple household appliances. These systems were becoming more and more common. Not only lightbulbs were created, but many complex devices such as weather stations, heating devices, air conditioners, audio-video, or parking systems. As the demand grew, these products were quickly supplemented by smart plug sockets, cameras, alarm devices, or security systems for entire buildings (fire, evacuation, gas detectors, etc.) [8].

According to opinions gathered during a research conducted in 2019 by the independent market research company Cite Research on a representative group of 1,000 Americans, smart devices will be widely available in less than 10 years, i.e. by the end of the 2030s. In Poland, the idea of a smart home or smart appliances is only just starting to gain popularity. It is estimated that in buildings built in 2018, smart devices were used in 23% of them [14].

Creating contemporary smart home facilities

The term "smart" has evolved in the very way we understand its meaning. "Smart" – what does that actually represent? Turning on and operating when it is needed, or when it is activated. A set of smart devices is supposed to provide comfort to a resident, but also increase the safety of operation, affect the work economy and energy consumption of other devices in the system [3]. The popularity of new systems is most often due to the possibility of using a virtual assistant, which is an advisor, or manager and observer of what we are not able to see and modify (because it happens on a digital plane). This is due to the connection of many devices in the system, a smart network of installations and subsystems [5].

Following the principle of economy, it is possible to monitor the installations of functionally complex buildings or even vast complexes of buildings. Smart building technology BMS (Building Management System) is often based on an integrated management system of installations with which it is equipped [9]. Such technology is used in hospitals, hotels, office buildings, shopping centres and malls and vast housing estates. BMS can be basically divided into:

- Open systems – allowing for connection and mutual communication of individual system elements; their basic feature is compatibility and availability to the public, also in servicing.
- Closed systems – based on technologies of selected manufacturers, used for particular functions, often designed exclusively for specialised installations.

Connecting these devices together in a system and automating them in order to optimise energy consumption or meet user requirements was supposed to allow us to make better use of the facilities already available in a building. It turns out that finding the optimal smart energy management system is becoming more and more challenging [6]. For many consumers, personalisation of the system remains an important asset. Despite the widespread use of wireless systems, many users still opt for a traditional cable connection, believing it to be more reliable.

Smart home systems

A set of smart home devices creates a personalised structure, with the primary task of improving user comfort (without the need to program these devices), thanks to the automatically adjusted interdependence of the work [12].

The basic classification of the SH system is related to the method of power supply of the facility; therefore, we divide it into cable and wireless systems. When designing a house with cable installations, we must anticipate the location of individual elements of the system and integrate them with the furniture in order to distribute the cabling under the plaster. Such cabling may prove troublesome, as changing the location of one element may result in the necessity to renovate the interiors. It is common for power cables to run through the building's structural elements, under the plaster or under finishing elements such as stone, mirror, or metal. However, the cable system has its supporters, due to its reliability and uninterrupted operation. The wireless system connects devices via a wireless WIFI network. One of the great advantages of this system is mobility, i.e., the possibility to change the configuration of individual devices. It works perfectly in open rooms without created partitions between them. In order to ensure proper functioning, good quality links with appropriate technical parameters are required [1].

Another division of the SH system differentiates the possibility of control of it; therefore, we divide it into:

- Centralised – where all component devices are connected to a central element controlling the operation. The only connection of the elements remains on the line – controlling centre – an element. In case of failure of the central controlling element, the system also fails.
- Decentralised – all the devices are connected to each other (without the central controlling element), in case of failure of one device, the other devices will operate excluding this one.

The SH system is most often controlled via WIFI (although there are also connections via Bluettooth or BLE) from connected devices, e.g., a smartphone via an appropriate application [10]. Earlier solutions included installation of an additional control element connected to the network, which would be placed in an accessible place, e.g., on the wall. Due to the increasing number of manufacturers of smart devices, it is important to remember to use a single brand in order to eliminate possible problems associated with the operation of the entire system (this is related to the use of different software by individual manufacturers).

Challenges for the future

The question for the near future is not "if" but "how" to specify the way in which smart technology systems (abbreviated as SH, should be implemented}. Overcoming the gap between the level of single-family houses and the level of public buildings and services is a very difficult challenge. Education of both consumers and designers and contractors seems to be necessary in this regard. This translates into the necessity to shape not only the building itself (as a solid figure), but also the natural environment exploited by its users. Nowadays, smart houses are not only a combination of technical solutions and application of the appropriate methods of their management: starting up, switching off, optimising of energy consumption, but also the possibility of connecting them to the system of ecological solutions [2]. It seems crucial to adjust the technological level of smart systems to the users' needs. Putting too many devices in a building may not appeal to their users. Too complicated devices and cumbersome maintenance may turn potential customers away from the system as an unnecessary extravagance that does not bring the expected benefits.

Modern construction should combine technological progress with integration of the building into the natural environment. Systems should not be limited to indoor equipment. Smart devices should also be used outside the building, e.g. for monitoring security systems, sprinkling and watering greenery, or identifying visitors. Providing appropriate conditions for investment and creation of smart building is becoming a driver of development [4]. Therefore, creation of new objects must be connected by coordination of planning and investor activities. At the same time, construction of such facilities on a wider scale must be recognised by local authorities, which should prepare in advance the necessary legal regulations and develop land with technical infrastructure for new investments.

Method

Research performed with a participation of students of the Faculty of Civil Engineering and Architecture of Lublin University of Technology (FCEA LUT), majoring in architecture, was aimed at determining the possibilities of applying and modifying the smart home system on a broader scale than single-family housing. The main focus of the research was to understand the problem and to further direct the work on expanding the possibilities of applying the SH system in different building configurations. As part of the module of classes on design, immediately before starting the project, students had to determine the possibilities of extending the evaluation criteria (use of the system), depending on the designed function of the building (while proposing alternative groups of criteria – relevant to the given function).

A group of 32 master's degree students participated in the study. Considering the number of students in their final semesters, one might say that this is a small representative group. Introduction and familiarisation with the issue has been made earlier within the framework of lecture classes, the results of which can be classified as important with regard to improving the level of education. The results of the research were to provide

a theoretical basis for the technical design of a multi-family or public building equipped with SH systems. The format of the research was a short questionnaire in the form of 4 open-ended questions, allowing the respondents freedom of expression, depending on the complexity of the subject. This type of question structure called for a greater involvement of the author of the research in systematising and classifying the answers. The quantitative statistical method was used to systematise the answers, so the answers with the largest number of criteria listed by the respondents were taken into account. Therefore, the group of 5 most popular answers in each criterion was presented visually.

Scientific research in architecture usually concerns new technologies of construction and equipment of buildings, their effects in connection with the education of students can serve as a basic source of increasing the scientific potential and creating future scientific staff [11] The choice of research technique that scientists use in their research is crucial. Hence the decision to choose a clear statistical method through questionnaires, which allows for interesting results in qualitative research.

Results of research and analysis

Providing answers to the questions was supposed to familiarise students with the specifics of designing smart buildings. The first question was to determine to what extent the creation of new smart systems makes sense in buildings with a large flow of people and whether it is really justified. The negative and neutral answers allowed the author to identify the group of students partially convinced or unconvinced by this technology. As can be seen from the answers, the vast majority of respondents can clearly see the point and accept this form of constructing of smart buildings.

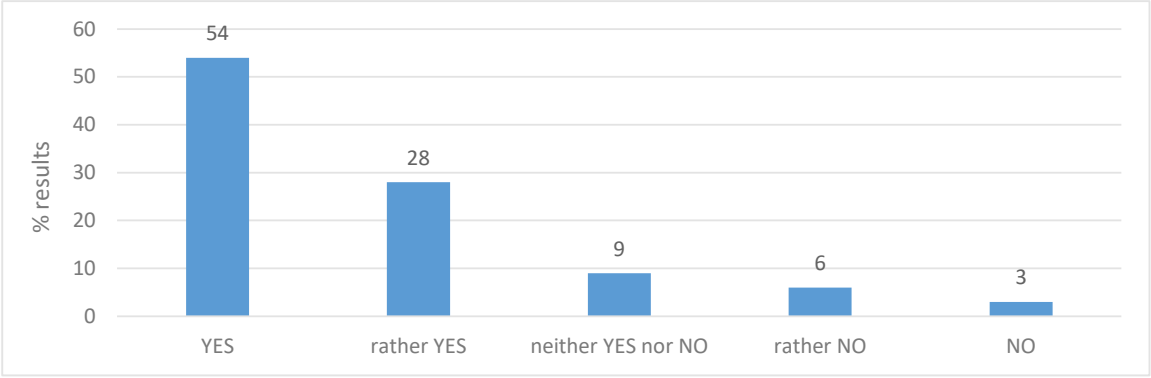

Fig. 1. Do you think that SH system should be used in public buildings and utility services?

The next question concerns the selection criteria, in other words, what the customers consider when deciding to install this system. The divergence of answers can be explained by the variety of installations we deal with and the priorities of the purchaser. Despite a significant drop in the prices of electronic equipment and the general availability of devices included in the SH, the price of the system still remains at the top of the criteria. Other priorities refer to the technical characteristics of the equipment, with particular emphasis on compatibility, sense of security of the home users, and measurable energy efficiency of the building. The financial outlay incurred in equipping a building with technological installations must quickly pay off, which is probably how this group of criteria should be interpreted.

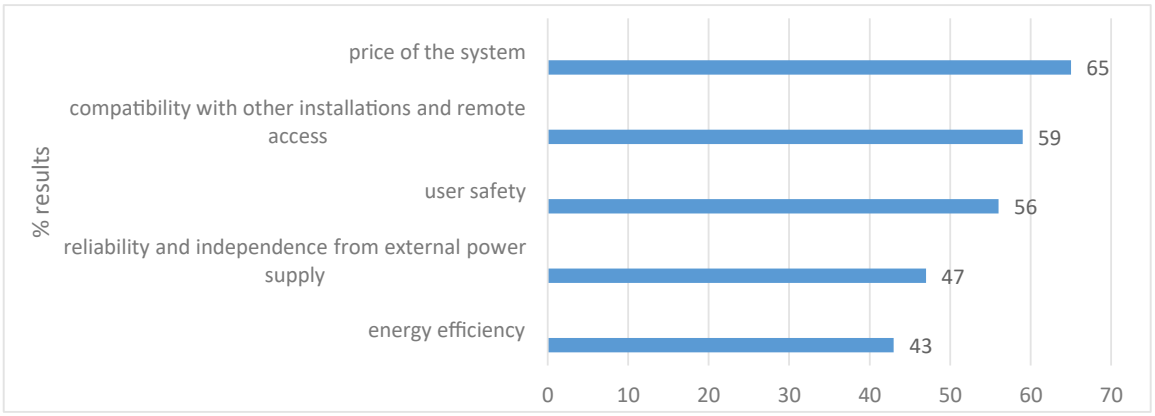

Fig. 2. What are the most important criteria for choosing an SH system?

Another question concerns the possibility of adapting the system to the functional and operational needs of this group of buildings. The author was interested to find out what features the buildings equipped with the SH system should have and what they should inform us about. In the first place in this group of criteria was the information on the number of people in a building or room. This may indeed be an important criterion not only because of the crowding in the interior, but also on the permissible number of people per given area (it might be used in connection to the recent restrictions related to the Covid 19 pandemic). Further criteria mentioned are the broadly understood comfort of the facility and the microclimate created in it (temperature, humidity, lighting, ventilation, etc.) and accessibility for specific users [7]. Just in the same way, personalisation becomes important for consumers, i.e. adapting the facility to individual needs, e.g. interactive tracks for moving around inside, verbal and non-verbal communication with a user.

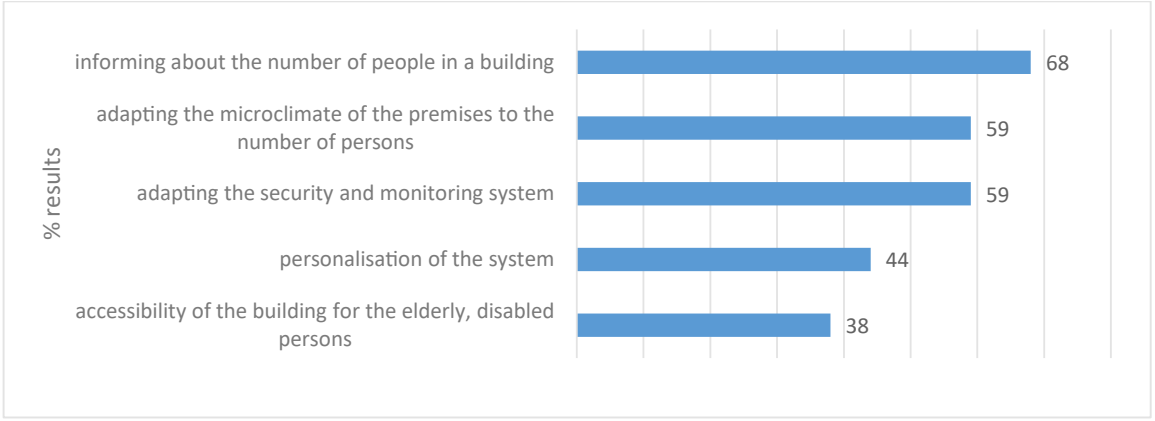

Fig. 3. What are the criteria for adapting smart home features to the needs of public buildings and utility facilities?

The last question concerned the criterion for extending the system in the future, focusing on the characteristics of smart buildings. In other words, what should smart buildings be distinguished by? The answers provided by participants of the survey were very thought-provoking, as some of them emphasised the necessity of using renewable energy as a source of power supply, part of them pointed out the necessity of paying attention to the form and aesthetics of the building, its location and covering the area adjacent to the plot with the system (plants watering, waste management, or creation of biomass for fertilisation).

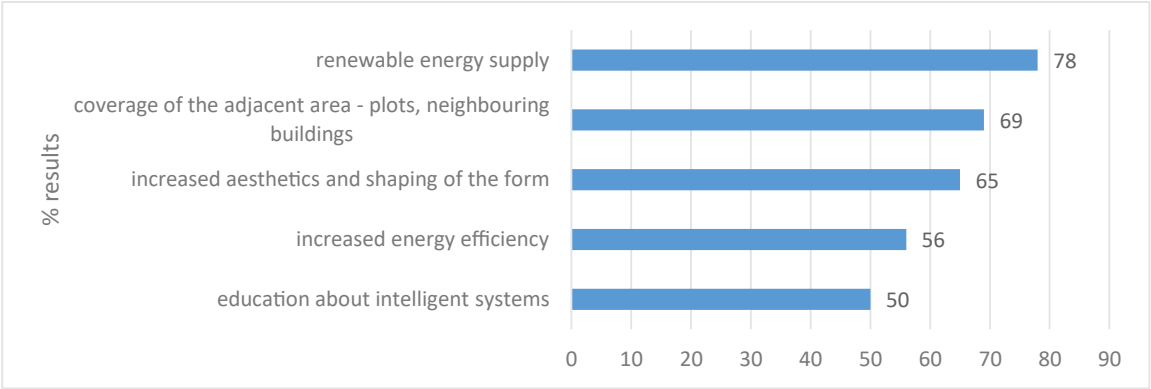

Fig. 4. What are the challenges for the future of the SH system?

Criteria of assessment of smart homes

The digital and ecological evolution, which is rapidly progressing right before our eyes, forces the necessity to use devices generating clean energy, obtained from natural sources – such as the sun, wind, or water. On the one hand, it is about protecting the environment and, on the other, becoming independent from traditional energy sources. This trend must be the leading one in defining the system development strategy for the following years. Technological development should be considered as civilisational and social development. Therefore, the creation of smart buildings should be perceived as a priority for economic progress, in terms of creating a sustainable environment for human habitation for the nearest future. This may be evidenced by systematic evaluation criteria of the system, presented in the table below.

Table 1. Systematics of evaluation criteria for SH systems

	Group of criteria 1	Specific criteria 2	Constraints and barriers 3	Measures 4
1	Architectural and construction	the shape and form of the building, the possibility of modifying the interiors, the use of modern building materials, structural solutions	lack of education of planners, wrong aesthetic patterns, lack of appropriate legal acts, lack of coordination of planning and investment activities	increase in the number of smart buildings handed over, increase in the number of people per facility
2	Ecological and environmental	installation of renewable energy systems, contact with nature, energy efficiency of appliances, use of biodegradable materials	initial cost of installing the system, limited production of suitable materials, lack of knowledge and its dissemination, lack of promotion	increase in the ratio of green and biologically active areas per 1 inhabitant, creation of adequate legislation

	Group of criteria 1	Specific criteria 2	Constraints and barriers 3	Measures 4
3	Technical	adaptation of the facilities to the needs of the elderly and disabled, provision of power supply networks to the site, preference for open systems that allow for expansion, system control from a smartphone, smartwatch or tablet	lack of adequately prepared technical staff, adaptation of price levels to consumer needs, lack of adequate financial resources	creation of new technologies, adaptation of SH technologies to user needs
4	Social – economical	personalisation of facilities and tailor-made installations, energy saving, safety of living, economic accessibility of equipment and facilities	conflict of interest between the producer – seller and buyer, fear of novelty, mental and cultural limitations	creating economic incentives for the development of intelligent buildings, education of the public

Conclusions

The presented results of the research indicate the need for further extension of the system with new functions, e.g.:

- Including eco-friendly energy saving devices.
- Personalising new versions of devices.
- Paying more attention to the safety of facilities.
- Adjusting the price of products to the economic possibilities of consumers.

Pro-environmental education of students who in the near future will be the people responsible for implementing the available technological solutions can positively influence the promotion of various forms of environmental protection, but also combining them with the digital environment, e.g. in the field of artificial intelligence. Creating clear criteria for assessment of SH system implementation can contribute to wider promotion and construction of facilities that meet future challenges [13]. A notable effect of creating interdisciplinary solutions is that they are easy to use and compatible with other already existing solutions. Continued education on the topic and widespread availability of technological solutions applied through digital devices of general access such as smartphones, smartwatches, and tablets will ensure a tangible effect in the future in the form of energy savings or creation of a friendly living environment. At the same time, we should strive to broaden the interdisciplinary knowledge of designers of technological devices and house designers well beyond the narrow specialisation of their field of study.

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Wykorzystanie i funkcjonowanie ruin zamkowych w Iłży

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Streszczenie: Niniejszy artykuł stanowi przedstawienie obecnego funkcjonowania, zagospodarowania, stanu badań oraz stanu technicznego ruin zamkowych w Iłży. Relikty warowni są jednym z najciekawszych obiektów znajdującym się na terenie województwa mazowieckiego. Ich położenie dominujące w sylwecie miasta wykazuje duże wartości krajobrazowe całego zespołu zamkowego, który stanowi element identyfikacyjny Iłży. Fortyfikacja od setek lat pozostaje w formie ruiny i jej forma jest utrwalona w pamięci i świadomości społeczeństwa. Obiekt ten obecnie jest udostępniony do ruchu turystycznego. Stale prowadzone są na nim również badania archeologiczne oraz tworzone nowe koncepcje zagospodarowania terenu zamku.

Słowa kluczowe: zamek, ruiny zamku, Iłża, zagospodarowywanie, historyczna ruina

Wstęp

Gotycko-renesansowy zamek Biskupów Krakowskich w Iłży jest obiektem niezwykle ważnym i cennym dla terenu Mazowsza. Warownia powstała ok. 1340 roku z inicjatywy Jana Grota. Zamek w Iłży był zamkiem miejskim, początkowo wyłączonym z obrębu fortyfikacji miasta.[1] Od początku swojego istnienia budowla ta uznawana była za jedną z lepiej ufortyfikowanych siedzib krakowskich biskupów[2]. Była wielokrotnie przebudowywana kolejno przez biskupów Floriana z Mokrska, Jana Konarskiego, Filipa Padniewskiego i Marcina Szyszkowskiego. Już w drugiej połowie XIV w. warownia została przekształcona w celu zwiększenia jej obronności. W połowie XVI i następnie w XVII wieku uzyskała renesansowy wygląd oraz fortyfikacje bastionowe. W 1655 r. zamek został zajęty oraz zniszczony przez Szwedów, a następnie dwa lata później zdewastowany przez atak wojsk Rakoczego. Odbudowy i remonty zamku prowadzone były w połowie XVII i w XVIII wieku. Kolejnych zniszczeń dokonano w trakcie Konfederacji Barskiej. W 1789 roku, w wyniku Sejmu Czteroletniego zamek przeszedł na własność państwa.

Obiekt zaczął stopniowo niszczeć już pod koniec XVIII w. Popadł całkowicie w ruinę w wyniku pożaru na przełomie XVIII i XIX w. Na początku XX wieku zespół zamkowy stał się przedmiotem zainteresowania, ochrony, licznych badań, prac konserwatorskich i porządkowych. Niestety dotychczas nie doczekał się prac zabezpieczających o charakterze kompleksowym. Obecnie zamek Biskupów Krakowskich utrzymywany jest w formie trwałej ruiny.

1 B. Pankowski, Stan badań archeologicznych nad średniowiecznymi zamkami dawnego województwa sandomierskiego, Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego, Tom XXX. Rzeszów 2009, s. 84.

2 https://medievalheritage.eu/pl/strona-glowna/zabytki/polska/ilza-zamek/ [dostęp: 12.07.2021].

Ruiny zamkowe w Iłży

Ruiny średniowiecznego zamku Biskupów Krakowskich w Iłży położone są w granicach obecnego województwa mazowieckiego, 27 km na południe od Radomia, we wschodniej części miasta – na wzniesieniu zwanym Górą Zamkową. U stóp wzgórza, od strony zachodniej znajdują się zabudowania miasta, natomiast od strony wschodniej teren łagodnie przechodzi w otaczające pola i łąki. Dolina rzeki Iłżanki oddziela skalny cypel wzgórza od miasta. Zespół zamkowy jest pod prawną opieką konserwatorską. Wpisany został do rejestru zabytków decyzją z dnia 24.03.1947 pod nr. A-23, decyzją z dnia 23.06.1967 pod nr. rej. A-156 oraz decyzją z dnia 18.03.1981 pod nr. rej. A-96. Do rejestru zabytków wpisano również park na wzgórzu zamkowym decyzją z dnia 24.03.1947 pod nr. rej. A-23.

Historycznie zamek w Iłży stanowił ufortyfikowaną siedzibę biskupów oraz pełnił funkcję centrum administracyjnego dóbr biskupich. Stacjonowało tu również wojskowo, następnie starostowie, a także miał tam swoją siedzibę sąd grodowy dla poddanych biskupów krakowskich.[3] Warownia była obiektem często odwiedzanym przez królów, zatrzymał się tu m.in. Aleksander Jagiellończyk, Zygmunt Stary oraz Zygmunt III Waza.[4]

Obecnie pozostałości budowli obronnej są największą atrakcją miasta.[5] Miejsce to posiada funkcję turystyczną, kulturalną i rekreacyjną. Dodatkowo, ze względu na swoje położenie, stanowi charakterystyczną dominantę w sylwecie miasta. Ruiny górują nad zabytkowym układem urbanistycznym Iłży (Ryc. 2), są widoczne z odległości wielu kilometrów z dróg wjazdowych i przejazdowych przez miasto. Główne otwarcia widokowe z terenu zamku uchwycono w opracowaniu studialnym z 1997 roku.[6]

Ryc. 1. Widok na ruiny zamku oraz miasto Iłża, 2018

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

3 https://medievalheritage.eu/pl/strona-glowna/zabytki/polska/ilza-zamek/ [dostęp: 12.07.2021].

4 https://zamek.ilza.pl/znani-na-zamku/ [dostęp: 12.07.2021].

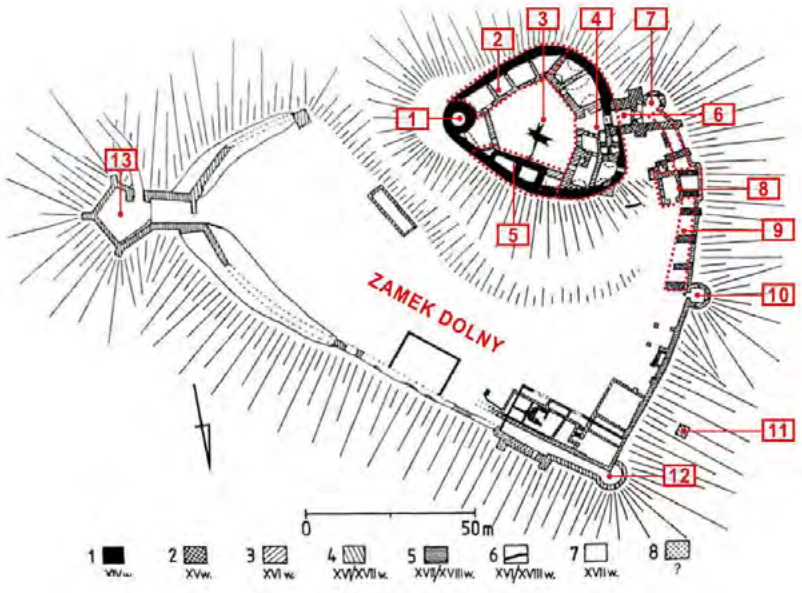
5 P. Langer, Rewitalizacja obszarów śródmiejskich w małych miastach – projekty i ich realizacja, Czasopismo Techniczne. Architektura, R. 109, z. 3-A, s. 255.

6 M. L. Lewicka, Kulturowe i społeczne wartości mazowieckich zamków w Liwie i Iłży [w:] Zamki w ruinie: zasady postępowania konserwatorskiego, B. Szmygin, P. Molski (red.), Lublin 2012, s. 172.

Teren wraz z Zamkiem od 1927 roku jest w rękach Miasta i Gminy Iłża.[7] Użytkownikiem baszty zamkowej jest Muzeum Regionalne w Iłży. Finansowanie ruin pochodzi w głównej mierze ze środków Miasta i Gminy Iłża. W 2012 r. zamek w Iłży otrzymał dotację od Urzędu Marszałkowskiego Województwa Mazowieckiego w Warszawie na wykonanie I etapu konserwacji i zabezpieczenia murów zamku górnego w Iłży. Budżet prac stanowił około 140 000 złotych. W 2013 roku wykonano ze środków Regionalnego Programu Operacyjnego Województwa Mazowieckiego na lata 2007–2013 II etap konserwacji i zabezpieczeń zamku górnego. W II etapie budżet prac wyniósł około 400 000 złotych. Prace towarzyszące związane z badaniami archeologicznymi, architektonicznymi i inwentaryzacyjnymi oraz utwardzenie ciągu pieszego na wzgórzu zamkowym były finansowane z budżetu Miasta i Gminy Iłża. W 2021 roku otrzymano dotację na 350 000 złotych z Ministerstwa Kultury i Dziedzictwa Narodowego na prace konserwatorskie i restauratorskie oraz odtworzenie części murów.[8] Dodatkowo Mazowiecki Wojewódzki Konserwator Zabytków przyznał dofinansowanie w kwocie 550 000 złotych na prace konserwacyjne i odtworzeniowe części murów zamku górnego, w zakresie niezbędnym do zachowania i ustabilizowania konstrukcji.[9] W ramach prac budowlanych rozpoczętych w czerwcu 2021 r., prócz zabezpieczenia murów, wykonane zostaną: odwodnienia dziedzińca oraz pomieszczeń zamku górnego, przebudowa betonowych schodów prowadzących na wieżę główną oraz tarasy widokowe w dawnych pomieszczeniach zamku.[10]

Architektura – forma historyczna i obecna

Na zespół zamkowy w Iłży składa się zamek górny położony na szczycie wzgórza oraz oddzielony od niego suchą fosą zamek dolny (podzamcze) znajdujący się na północy założenia. Forma architektoniczna zespołu dostosowana została do układu terenowego wzgórza, na którym powstało założenie. Zamek wybudowano z łamanego kamienia wapiennego ze wzmocnieniami na narożach z wapiennych ciosów. Powierzchnia pierwotnego założenia wynosiła ok. 1500 m^2.[11]



Ryc. 2. Plan zamku w Iłży

1. Wieża główna, 2. Skrzydło południowe, 3. Dziedziniec, 4. Skrzydło zachodnie, 5. Skrzydło północne, 6. Wieża bramna, 7. Baszta południowo-zachodnia, 8. Wieża przedbramna, 9. Relikty filarów mostu, 10. Baszta zachodnia, 11. Kapliczka, 12. Baszta północno-zachodnia, 13. Bastion bramny

Źródło: opracowanie własne na podstawie plan zamku wg S. Medekszy z uzupełnieniami J. Lewickiego, https://medievalheritage.eu/pl/strona-glowna/zabytki/polska/ilza-zamek/.

7 Archiwum Zakładowe Wojewódzkiego Urzędu Ochrony Zabytków w Warszawie Delegatura w Radomiu (AZ WUOZ DwR), sygn. 296, A. Penkalla, Właściciele wzgórza zamkowego w Iłży w XIX-XX w. Informacja archiwalna, 1993, s. 2.

8 https://www.gov.pl/web/kulturaisport/ochrona-zabytkow3 [dostęp: 12.07.2021].

9 https://bip.mwkz.pl/uploads/images/dotacje/2021/WNIOSKI_DOTACYJNE_OBJETE_DOFINANSOWANIEM_2021r.pdf [dostęp: 12.07.2021].

10 https://www.ilza.pl/aktualnosc-426-rewitalizacja_ilzeckiego_zamku_staje.html [dostęp: 12.07.2021].

11 B. Pankowski, op. cit., s. 84.

Zamek górny zbudowany został na planie nieregularnego owalu. Jego najstarszym oraz najbardziej charakterystycznym elementem jest okrągła wieża główna (Ryc. 2, nr 1) usytuowana w południowo-wschodniej części założenia. Wieża główna powstała prawdopodobnie w I poł. XIV w. Stanowi ona element typowy dla obiektów obronnych systemu wieżowego klasyfikowanych jako układ ośrodkowy o odmianie słupowej.[12] Początkowo zwieńczona była izbicą, natomiast w II poł. XVI w. przykryto ją reprezentacyjnym hełmem. Obecnie jej wysokość wynosi ok. 25 m, średnica korony wynosi 8 m, natomiast grubość murów zmniejsza się ku górze, od 2,45 m do 0,8 m.[13] W podobnym czasie co wieża, powstał dom mieszkalny w północno-zachodniej (Ryc. 2, nr 5) części warowni.

W drugiej fazie przebudowy wzmocniona została brama wjazdowa na teren zamku górnego. Poza obrębem murów powstała czworoboczna wieża bramna z przyporami w narożach (Ryc. 2, nr 6). Wieża bramna była drugim co do wysokości elementem zespołu. Do zamku prowadził most kamienny oparty na filarach (Ryc. 2, nr 9), który składał się z kilku odcinków, w tym dwóch części zwodzonych, a ostatnie przęsło mostu było podnoszone. Na drodze dojazdowej mostu usytuowano wieżę przedbramną (Ryc. 2, nr 8).[14]

Ryc. 3. Widok na zamek górny i relikty zamku dolnego w Iłży, 2018

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Dziedziniec (Ryc. 2, nr 3) wówczas zamknięty był od północy domem wielkim, natomiast od południa murem obwodowym. Pozostałe zabudowania gospodarcze rozlokowane były dookoła dziedzińca. W XVI wieku powstała również zabudowa przedzamcza oraz fortyfikacje bastionowe otaczające zamek niski. W tym czasie powstały również obwarowania miejskie, które połączono z zamkiem. Przy wieży bramnej znalazła się baszta południowo-zachodnia (Ryc. 2, nr 7), a wzdłuż kurtyny zachodniej powstały jeszcze dwie baszty. Zadaniem baszty południowo-zachodniej (Ryc. 2, nr 7) było wzmocnienie obrony wieży bramnej. Baszta zachodnia (Ryc. 2, nr 10) ulokowana była przy wieży przedbramnej (Ryc. 2, nr 8) i początku mostu (Ryc. 2, nr 19) prowadzącego do zamku górnego. Natomiast baszta północno-zachodnia (Ryc. 2, nr 12) kontrolowała dojazd do zamku od

12 J. Bogdanowski, Architektura obronna w krajobrazie Polski: od Biskupina do Westerplatte, Warszawa-Kraków 1996, s. 70.

13 P. Nowakowski, Dzieje zamku Iłża przewodnik turystyczny, Iłża 2019, s. 18.

14 https://medievalheritage.eu/pl/strona-glowna/zabytki/polska/ilza-zamek/ [dostęp: 12.07.2021].

strony miasta.[15] W XVII w., podczas kolejnych przebudów i umacniania warowni, powstał beluard w formie bramy wschodniej (Ryc. 2, nr 13).

Obecnie ruiny zamku stanowią czytelny obrys tzw. zamku górnego z dominantą w postaci wieży głównej (Ryc. 3). W stanie ruiny zachowany jest także mur obwodowy, zespół bramny po stronie wschodniej z wieżą przejazdową na planie czworoboku, cokoły wieży bramnej, mury zabudowy wewnętrznej przylegające do muru obwodowego (pomieszczenia na planie czworokąta w układzie jednotraktowym), dwie sklepione kolebkami piwnice na południe od dawnego wjazdu, pozostałości nowożytnej klatki schodowej przy przejeździe bramnym oraz dziedziniec zamkowy z fragmentami bruku. Na terenie podzamcza znajdują się relikty fortyfikacji bastionowych; baszty południowo-zachodniej; baszty zachodniej oraz baszty północno-zachodniej.

Badania prowadzone na obiekcie oraz stan techniczny ruiny

Ruiny zamku w Iłży są w złym stanie technicznym, wiele elementów znajduje się w stanie awaryjnym. Niska jakość oraz słaba trwałość kamienia wapiennego sprawia, że mury nieposiadające zabezpieczenia ulegają szybkiej degradacji. Proces niszczenia obiektu trwa ciągle, a wręcz jest przyspieszony ze względu na to, że niektóre elementy zamku, po wykonanych badaniach archeologicznych (szczególnie miejsca w rejonie bramy wjazdowej w skrzydle zachodnim) nie zostały zabezpieczone. Na terenie obiektu wielokrotnie prowadzone były prace badawcze, zabezpieczające oraz rekonstrukcyjne. Jednakże nigdy działania te nie miały charakteru kompleksowego. Jedynie wieża główna została całościowo objęta pracami zabezpieczającymi i zagospodarowana do celów turystycznych.

Prace na obiekcie prowadzone były od 1909 roku, kiedy to Zdzisław Lubomirski przekazał zamek wraz z otoczeniem Towarzystwu Opieki nad Zabytkami Przeszłości w Warszawie. W tym czasie powstałą pierwsza dokumentacja i inwentaryzacja pozostałości budowli obronnej. W kolejnych latach, dzięki finansom przekazanym przez Wydział Archeologii TOnZP w Warszawie przeprowadzono prace zabezpieczające zamek, które trwały aż do wybuchu I wojny światowej. Wykonano w tym czasie zabezpieczenia przy murze obwodowym i przy bramie wjazdowej na zamku górnym oraz uzupełniano ubytki w wieży głównej. W 1927 roku TOnZP odsprzedało zamek gminie Iłża i od tego czasu ruiny zaczęły funkcjonować jako obiekt turystyczny.

W latach 1962–1978 z przerwami prowadzone były badania archeologiczno-architektoniczne przy zamku w Iłży. Prowadzone były przez Zakład Historii Architektury, Sztuki i Techniki Wydziału Architektury Politechniki Wrocławskiej. Pracami badawczymi kierowali w latach 1962 Jerzy Rozpędowski i Józef Kaźmierczyk, natomiast od 1969 do 1978 r. archeolog Adam Kudła oraz architekt Stanisław Medeksza. W tym okresie rozpoznawano obiekt przy wjeździe na teren zamku oraz na jego dziedzińcu. Wynikiem działań było rozpoznanie układu przyziemia zamku. Odgruzowano także bramę wjazdową i fragment murów obwodowych oraz częściowo odkryto brukowany dziedziniec, odsłonięto nowożytny element obronny – beluard (wschodni bastion bramny). Kolejne badania odkryły przejazd przez bastion oraz bramę wschodnią.[16]

Na zlecenie Gminy Iłża w oparciu o zalecenia WUOZ Delegatura w Radomiu w 2009 roku miały miejsce kolejne prace archeologiczno-architektoniczne. Przed badaniami przystąpiono do odgruzowywania pomieszczeń skrzydła południowego oraz części dziedzińca. W jednym z pomieszczeń odsłonięto kamienne ocembrowanie zamkowej studni. Prace te kontynuowano w 2015 roku. Kierownikiem badań był dr Zbigniew Lechowicz, a konsultantem prof. Leszek Kajzer. Badaniami objęto wieżę bramną, pomieszczenia w skrzydle zachodnim, zagruzowane pomieszczenia skrzydła północnego oraz północną część dziedzińca. Prace miały sięgać pierwotnych poziomów użytkowych.

Powstało również kilka projektów związanych z adaptacją i zabezpieczeniem murów zamku górnego. W 1993 roku architekt Andrzej Kadłuczka wykonał projekt zagospodarowania wzgórza zamkowego, adaptacji ruin oraz ich konserwacji.[17] W 1995 projekt został częściowo zrealizowany – przystosowano wieżę główną do celów turystycznych. Wykonano schody prowadzące na taras widokowy na ostatnim piętrze, który zadaszono

15 P. Nowakowski, *op. cit.*, s. 26.

16 AZ WUOZ DwR, sygn. 2015/323, Z. Lechowicz (red.), Iłża. Zamek Górny 2015 rok. Dokumentacja z odgruzowania i badań archeologicznych, 2015, s. 3.

17 AZ WUOZ DwR, sygn. 295, A. Kadłuczka, Adaptacja ruin zamku w Iłży. Projekt, 1993, s. 3.

lekką konstrukcją parasolową z przykryciem poliwinylowym. Kolejny projekt dotyczący konserwacji i zabezpieczenia murów zamku górnego wykonany został w 2010 roku przez architektów Jana Salm i Beatę Salm.[18] Przyjęto w nim zasadę utrzymania trwałej ruiny bez prowadzenia działań rekonstrukcyjnych. Po 2012 roku, na podstawie projektu odtworzono fragment muru obwodowego na zamku górnym, a przylegające pomieszczenia pokryto dachem z gontu (modyfikacja projektu Jana Salm).[19]

W 2016 roku powstała koncepcja architektoniczna i funkcjonowania zamku górnego w części północnej wykonana przez dra inż. arch. Tomasza Grzelakowskiego i mgra inż. arch. Radosława Czekalskiego. Koncepcja podtrzymywała zasadę z projektu z 2010 r. dotyczącą utrzymania obiektu w formie trwałej ruiny. Projekt zakładał wykonanie żelbetowych tarasów widokowych opartych na obniżonej i wyrównanej koronie murów.[20] W 2018 roku rozpoczęto jego realizację. Projekt został zatwierdzony przez Delegaturę w Radomiu MWKZ, wykonano część prac, podczas których odsłonięto poziomy użytkowe czterech pomieszczeń. W połowie roku MWKZ wstrzymało prace prowadzone na obiekcie, ponieważ stwierdzono że zatwierdzony wcześniej przez delegaturę MWKZ w Radomiu projekt stanowi zagrożenie dla zabytku. Wykonana opinia dra inż. arch. Marcina Górskiego ukazała niebezpieczeństwa wynikające z kontynuacji prac dla zamku.[21]

Obecnie, pomimo prowadzonych wcześniej prac konserwatorskich i zabezpieczających mury zamku górnego są w stanie technicznym niedostatecznym. Brak zabezpieczeń koron murów wykonanych z niskiej jakości materiału powoduje stałe niszczenie obiektu. W miejscach niezabezpieczonych występują różnego typu uszkodzenia konstrukcyjne i powierzchniowe. W murach występują między innymi liczne rysy, spękania, uszkodzenia lica, ubytki w spoinowaniu oraz intensywna degradacja spowodowana krystalizacją solną. W spoinach zalegają warstwy humusowe powodujące intensywny rozrost roślinności. W miejscach wykonanych wcześniej zabezpieczeń koron doszło do ich degradacji pod wpływem czynników atmosferycznych. Wykonane zabezpieczenia miały charakter czasowy i w związku z brakiem bieżących interwencji doszło do ich zużycia.[22]

Ryc. 4. Mur w północno-wschodniej części zamku górnego – widoczne liczne uszkodzenia muru oraz znaczna degradacja lica muru

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Ryc. 5. Mur wewnętrzny w zachodniej część zamku – degradacja korony murów spowodowana rozrostem roślinności. Korozja mrozowa oraz solna występująca w środkowej części muru

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

18 AZ WUOZ DwR, sygn. 273, J. Salm, B. Salm, Projekt konserwacji i adaptacji ruin zamku górnego w Iłży woj. mazowieckie. Koncepcja, 2010.

19 J. Lewicki, Ochrona i konserwacja ruin – przemiany metod na przykładzie Mazowsza, Ochrona Dziedzictwa Kulturowego, (6), 2018, s. 119.

20 AZ WUOZ DwR, sygn. 2016/160, T. Grzelakowski, R. Czekalski, Projekt architektoniczno-budowlany wykonania robót budowlanych dotyczących zabezpieczenia pozostałości murów zamku górnego w części północnej, 2015.

21 J. Lewicki, *op. cit.*, s. 120.

22 K. Drobek, B. Szostak, B. Szmygin, M. Trochonowicz, Strategia ochrony ruin zamków woj. mazowieckiego – ocena stanu technicznego, zalecenia napraw, program ochrony – cz. II. Ocena stanu technicznego. Badania „in situ" i badania laboratoryjne, 2019.

Ryc. 6. Południowo-wschodnia część zamku – intensywna korozja solna i mrozowa we fragmentach muru z cegły ceramicznej

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Ryc. 7. Zachodnia część zamku – całkowicie zniszczony fragment muru zewnętrznego. Miejsce niezabezpieczone po prowadzonych i nieukończonych pracach remontowych

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Sposób użytkowania i obecne zagospodarowanie zespołu zamkowego

Zespół zamkowy w Iłży udostępniony jest do ruchu turystycznego. Do 2020 roku dostęp na zamek górny był niekontrolowany, dlatego też nie było możliwe uzyskanie informacji dotyczących liczby odwiedzających. Do tego czasu za dopłatą dla turystów dostępna była wieża główna zarządzana przez Muzeum Regionalne w Iłży. W 2018 roku sprzedano na nią 10 250 biletów[23] (dzieci do lat 7 wchodzą bez biletu). Z dużym prawdopodobieństwem, ze względu na brak biletowanego wstępu na teren zamku, ruch turystyczny był znacznie większy. Według informacji na oficjalnej stronie zamku, od sierpnia 2020 roku opłata obowiązuje również za zwiedzanie terenu dziedzińca zamku górnego. Wstęp na dziedziniec dolny w dalszym ciągu jest bezpłatny. Teren wzgórza zamkowego można zwiedzać przez cały rok, natomiast taras widokowy na baszcie dostępny jest w okresie od 1 maja do 30 września. Zamek można zwiedzać indywidualnie oraz z przewodnikiem.[24]

Pierwotnie dojście na wzgórze zamkowe poprowadzony było po jego zachodniej stronie. Na zamek górny dostać się można było poprzez most, biegnący niemalże równolegle do murów obronnych zamku górnego. W końcowej części skręcał ku wieży bramnej. W dwóch fragmentach most był zwodzony. Do dnia dzisiejszego zachowały się jedynie relikty bramy z przedbramiem oraz filary mostu.[25]

Aktualnie na wzgórze zamkowe można dostać się dwoma drogami. Pierwsze dojście rozpoczyna się od ul. Podzamcze (Ryc. 8) (naprzeciwko targowiska) i prowadzi przez betonowe schody terenowe wykonane w latach 90 XX w. na podstawie projektu z 1974 r.[26] Natomiast drugie nieutwardzone dojście, o charakterze naturalnym, znajduje się od ul. świętego Franciszka, wzdłuż południowego zbocza Góry Zamkowej (Ryc. 9). Wejście na zamek górny znajduje się od strony wschodniej w miejscu dawnej sieni i kuchni, tuż przy wieży głównej. Dojście poprowadzono przez nasyp wykonany przez zasypanie części fosy (lata 1993–1995).

Na wzgórze jest także możliwość dojazdu samochodem. Droga prowadzi przez ul. świętego Franciszka (Ryc. 9) lub ul. Kampanii Wrześniowej. Parking znajduje się tuż przy południowym stoku wzgórza, dodatkowo jest możliwość parkowania w okolicznych uliczkach oraz na parkingu przy targowisku miejskim.

23 Informacja przekazana przez Muzeum Regionalne w Iłży.

24 https://zamek.ilza.pl/ [dostęp: 12.07.2021].

25 K. Drobek, B. Szostak, B. Szmygin, M. Trochonowicz, Strategia ochrony ruin zamków woj. mazowieckiego – ocena stanu technicznego, zalecenia napraw, program ochrony – cz. IV. Strategia działań, Lublin 2019.

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Ryc. 8. Wejście na wzgórze zamkowe od ul. Podzamcze

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Ryc. 9. Wejście na wzgórze zamkowe od ul. świętego Franciszka

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Dla odwiedzających dostępny jest także sporej wielkości teren wzgórza zamkowego. Zamek górny jest w niewielkim stopniu przystosowany do ruchu turystycznego. Udostępniona jest wieża główna, na szczycie której znajduje się punkt widokowy. Dostęp do niej prowadzi początkowo przez zewnętrzne schody żelbetowe, natomiast w jej wnętrzu wykonano schody wachlarzowe wspornikowe o konstrukcji stalowej. Z tarasu widokowego wieży zamkowej oglądać można rozległe panoramy miasta oraz okolic, a widoczność sięga wielu kilometrów. W pomieszczeniach skrzydła południowego znajduje się niewielka ekspozycja związana z historią zamku.

Ryc. 10. Brukowana ścieżka i elementy małej architektury na terenie wzgórza zamkowego

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Ryc. 11. Widok z dziedzińca zamku dolnego na zamek górny

Źródło: Archiwum Katedry Konserwacji Zabytków Politechniki Lubelskiej.

Rozległy dziedziniec zamku dolnego, w granicach dawnych murów, jest porośnięty roślinnością trawiastą. Na jego terenie założenia brak konkretnego zagospodarowania terenu, znajduje się tu niskiej jakości mała architektura, tj. ławki, śmietniki (Ryc. 10). Wytyczone są również ścieżki spacerowe, wykonane z bruku kamiennego. Ze względu na duże różnice wysokości, w niektórych miejscach przy wytyczonych ciągach pieszych znajdują się zabezpieczenia w formie drewnianych barierek.

Na terenie zamku dolnego oraz w wąwozie znajduje się zieleń o charakterze leśno-parkowym z kilkudziesięcioletnimi drzewami. Skarpy wzgórza zamkowego porośnięte są krzewami oraz niskimi drzewami. Zieleń ta ma charakter inwazyjny, wpływa destrukcyjnie na relikty elementów obronnych znajdujących się przy zboczach.

Podsumowanie

Bezsprzecznie można stwierdzić, że ruiny zamku w Iłży są obiektem niezwykle ciekawym i ważnym dla województwa mazowieckiego i miasta. Niestety ich nikłe przystosowanie do ruchu turystycznego oraz przede wszystkim zły stan techniczny sprawiają, że warownia nie wykorzystuje w dostatecznym stopniu swojego potencjału. Niewielka ilość kubatur, brak konkretnych tras zwiedzania, brak zaplecza sanitarnego, brak informacji o obiekcie sprawia, że ruiny w Iłży stają się jedynie miejscem jednorazowego pobytu. Wizyty turystów są krótkie. Według informacji na oficjalnej stronie zamku, indywidualne zwiedzanie zajmuje około 45 minut. Dodatkowo oferta kulturalna obiektu jest uboga. Na terenie wzgórza zamkowego odbywa się cyklicznie jedno wydarzenie – turniej rycerski.

Zamek wraz z terenem jaki zajmuje, posiada ogromne możliwości jeżeli chodzi o jego wykorzystanie. Ruiny bezwzględnie są elementem identyfikacji miasta, częścią historycznej tożsamości oraz stanowią dominantę krajobrazową w sylwecie Iłży. Niewielka ilość kubatur zamku górnego w swej obecnej formie obecnie nie pozwala na stworzenie szerszego program funkcjonalnego. Ewentualne nowe pomieszczenia powstałe w wyniku częściowej odbudowy ruin mogłyby służyć ekspozycji i zapleczu technicznemu, a przekrycie pozostałości dachem pozwoliłoby na zabezpieczenie przed dalszym niszczeniem. Ogromny teren zamku dolnego natomiast pozwala na organizację różnego rodzaju wydarzeń plenerowych o różnej skali, a także stanowić miejsce wypoczynku, rekreacji i aktywności lokalnej ludności.

Zamek biskupów krakowskich w Iłży wymaga całościowego opracowania dotyczącego zarówno kompleksowej koncepcji zabezpieczenia jak i zagospodarowania zespołu zamkowego oraz dokumentacji architektoniczno-konserwatorskiej. Opracowanie te powinny uwzględniać formę ewentualnej odbudowy wybranych elementów oraz rozwiązania techniczne służące zabezpieczeniu substancji historycznej i powstrzymaniu procesu destrukcji.

Według Mazowieckiego Wojewódzkiego Konserwatora Zabytków dra Jakuba Lewickiego istnieje również szansa na uznanie obiektu za pomnik historii. Bez wątpienia byłoby to ogromną szansą dla tego zabytku i pozwoliło na zabezpieczenie pozostałości obiektu w całości.[27]

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Use and functioning of the castle ruins in Iłża

Abstract: The article presents the current functioning, development, state of research and technical condition of the castle ruins in Iłża. The relics of the fortress are one of the most interesting objects located in the Masovian Voivodeship. Their location in the city shows great landscape values of the entire castle complex, which is the identification element of Iłża. For hundreds of years, the fortification has been kept in the form of a ruin and its form is preserved in the memory and consciousness of the society. The castle is currently open to tourist traffic. Archaeological research is also carried out there and new concepts for the development of the castle area are created.

Keywords: castle, castle ruin, Iłża, development, historic ruin

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Criteria of livable public spaces quality. Case study analysis on the example of selected public spaces Lublin, Poland

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Abstract: The aim of the research presented in this paper was to assess the attractiveness of selected public spaces located in the downtown of Lublin in a specific moment of time – after the experience of the Covid-19 pandemic. The research made it possible to determine the predisposition of studied spaces to be places providing peace, relaxation, tranquility in which people willingly spend their free time. At the same time, the results of the questionnaires were confronted with the surveys of spaces according to Jan Gehl's methodology of 12 Quality Criteria of Successful, Livable Space. The aim of the study was to check whether the popularization of the idea of creating a city for the people has a real impact on the realization of the newest public spaces which can be considered as new landmarks for Lublin. Selected public spaces of different kinds were analyzes according to fulfilling 12 Quality Criteria and with user's perception survey (questionnaire).

Keywords: Livable Public Space, Public Green Spaces, User's perception, Identity

Introduction

Public spaces are an integral part of cities, but nowadays we expect more from them than before. This is especially true in terms of the quality of public spaces and the contribution of nature to their creation. The emergence of the Covid-19 pandemic has made it clear how necessary it is to spend time in public spaces and how important it is for people's well-being and mental health to go outside their homes. The multitude of activities traditionally and intrinsically linked with public spaces, such as travel, commerce, collective cultural events, sports, were restricted due to the Covid-19 pandemic. The reopening of public spaces for public in Poland took place in the spring of 2021. The moment when public spaces became accessible became a pretext for conducting a qualitative study of selected public spaces in Lublin, concerning the perception of these spaces by the inhabitants after the pandemic or during its pause. The time of the research was also a pretext for determining the role of public spaces in the situation of the covid-19 pandemic.

The research also included the influence of Jan Gehl's theory concerning principles of successful, livable public spaces design on the latest realizations of public spaces in Lublin. Professor Jan Gehl has visited Lublin twice. The first time was in 2008, as part of the International Architecture Workshop organized by the Mayor of Lublin. It was a period of intensive preparations for announcing a competition for revitalization works of the main public space of the city center – Litewski Square. The workshop gave rise to a public discussion about the sensitive urban space, its quality and the directions for necessary changes. The next time Jan Gehl visited Lublin was in 2014, when, on the initiative of local NGOs, the city hall, public institutions and the academic community, the Year of Jan Gehl in Lublin was declared. Accordingly, a number of events were held in 2014 to popularize good design of public spaces and to point to a participatory model of urban management [1]. Thus, professor Jan Gehl's methodology is known in the local environment not only to architects and urban planners, but also to urban activists and people involved in shaping public spaces.

Materials and Methods

The aim of this study is to identify the factors determining the attractiveness of modern livable urban spaces on the example of Lublin, so that they are conducive to rest, relaxation and emotional development at this particular moment: after their reopening during the pandemic. It is difficult to assess whether this moment can already be called post-pandemic or whether it is just a pause in the global pandemic. Another aim is to check whether the influence of the ideology of designing public spaces according to Professor Jan Gehl, their outstanding researcher, is visible. The research of selected public spaces within Lublin was based on research methods used in the evaluation of such spaces in cities. These include research walks, expert evaluation in terms of field observations and photographic documentation, as well as collecting user opinions through surveys collecting data about user's perception [2]. Information available on websites and literature was also used for further description of case studies. Studied Areas were analyzed according to fulfilling 12 Quality Criteria of Successful, Livable Space created by Jan Gehl as a tool which works in a variety of public space types: plazas, parks, squares, and streets. Criteria concern: protection, comfort and enjoyment. The surveys (observing and assessing individual public space whether they live up to the criteria) were performed by the authors from 15.05.2021 till 15.08.2021 in each selected space in weekends and during the week. For every criterion, scores were given regarding selected aspects assigned to a given criterion: 1, 0.5, or 0 (meaning fulfilling the criterium, in between, or no, respectively). In case of Comfort criterion elements analyzed were more detailed so scores given in range 0.5–0 maenad meaning fulfilling the criterium or no [Table 2].

The methodology of The Twelve Quality Criteria was also checked for two case studied public spaces created on green roofs, which are relatively modern solutions. The aim of the research was also to check the usefulness of this method in the context of the convergence of its results with the users' assessment.

Surveys were carried out to determine which elements of their development are factors determining their attractiveness. The research was conducted between May and June 2021 on a group of 200 respondents of different ages currently living in and around Lublin. Out of those who answered the questionnaire, 142 were women and 58 were men. Half of the respondents were currently studying, the rest were between 35 and 48 years old, with the majority of women. The choice of the research group was dictated by the preliminary understanding of the user group profile.

As a result of the presented research, attention was drawn to the elements which directly influence the attractiveness of given spaces, thus increasing the frequency of their visits. The assessment of the attractiveness of selected areas took into account: aesthetic, functional, social and emotional values. The most important research issue was to show the relationship between urban spaces and their attractiveness in social terms, with particular attention paid to the role of art as a tool for reviving them.

In the research, the free Microsoft Office 365 platform (www.office.com) was used, in which a questionnaire containing 22 questions with multiple choice options was prepared. The application allowed for efficient distribution of questionnaires, their timely collection and calculation of results. Spatial information databases (GIS) were used: https://mapy.geoportal.gov.pl/imap/Imgp_2.html?gpmap=gp0, and publicly available websites to obtain information about the current situation of the city.

For the purpose of this article a review of the literature on the subject was carried out with particular emphasis on the latest publications concerning the valuation of public spaces and their role in the post-covid city. Five public spaces in Lublin were selected as case studies and subjected to detailed analyses: which included on-site observations, analyzing historical and social background, activities and functions currently occurring in the selected spaces, current technical and aesthetic condition, and the presence of elements of art and nature. The field surveys concerned relations between scale of public spaces, its programming (commercial and cultural initiatives), furnishing and landscaping were held in the same time as assessing The Twelve Quality Criteria). To interpret the results, the methodology developed by professor Jan Gehl [3–5] was adopted, which can now be considered "classical" in terms of the assessment of quality criteria for public spaces. It was against this background that the research questions were formulated and then used in the survey, referring to selected public spaces in Lublin.

The survey considered factors influencing the user's perception of the immediate environment, which are directly related to residents' sense of well-being and the satisfaction of their needs in terms of function and

aesthetic experience. Although the studied areas differs in scale and typology (squares, parks and green roofs), all of them are considered to be landmarks places in Lublin, with strong identity.

Conclusions were drawn on the basis of survey showing quantitative data and perceptions of users, as correlated with the level of livable and successful public space.

Case study areas selection

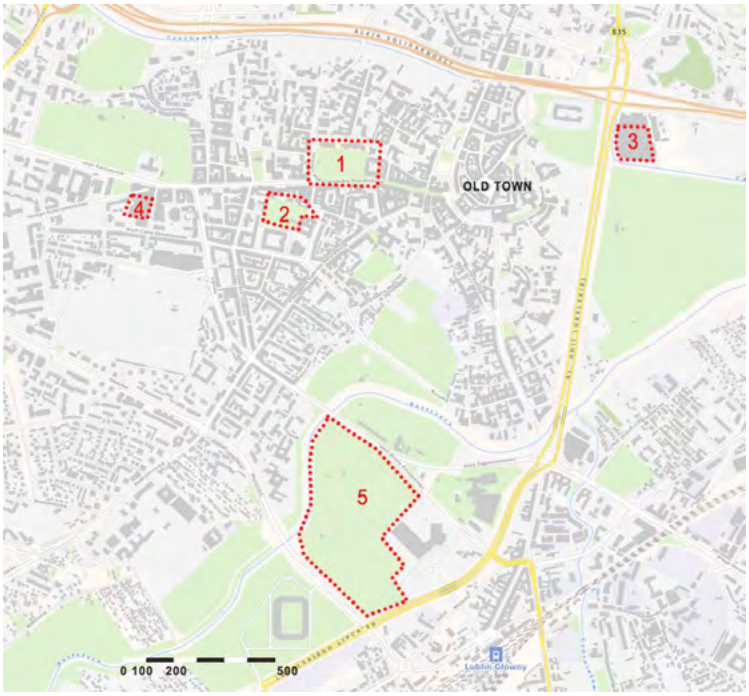

Fig. 1. Distribution of the studied spaces in the center of Lublin

1 – Litewski Square, 2 – square at the Cultural Centre, 3 – Galeria Vivo roof, 4 – roof of the Centre for the Meeting of Cultures, 5 – People's Park (Park Ludowy).

Lublin is one of the major Polish cities. The city is located in central-east Poland about 160 km from capital Warsaw. 9th location in terms of population (about 340 000 in 2019) and 16th location in terms of area (147.5 km^2). The population density is 2304 people per km2 (in 2017). Lublin can be classified as a medium-sized, university city (about 80,000 students) with aspirations towards metropolitan development. The research background is provided by the results of a study on aspects related to public spaces and urban landscape design as well as the needs of the inhabitants, carried out by the Lublin Research Group for the purposes of developing the Lublin 2030 Strategy [6–7].

Five public spaces differing in time of creation, leading function, size and character were selected for analysis [Fig. 1]. These spaces enjoy general popularity among users. The common feature linking them is the time of refurbishment, revitalization, or the introduction of significant changes which have increased the popularity of these places – the last 5 years. As the spaces differ in scale character and spatial context, it was considered that each could be representative of its type [Table 1]:

- Case Study 1 – Litewski Square – the main multifunctional city square,
- Case Study 2 – square at the Cultural Centre (CK) – an intimate square in the city center,
- Case Study 3 – Galeria Vivo roof – a space accompanying a commercial function (the roof of a shopping mall),
- Case Study 4 – roof of the Centre for the Meeting of Cultures in Lublin (CSK) – space accompanying the cultural institution,
- Case Study 5 – People's Park (Park Ludowy) – a contemporary active recreation park of city-wide significance.

Table 1. Surveyed public spaces – summary of key data concerning relations between scale, programming, landscape and furnishing

	Case Study Area 1 Litewski Square	Case Study Area 2 Square at the Cultural Centre	Case Study Area 3 Galeria Vivo roof	Case Study Area 4 Roof of the Meeting of Cultures Centre	Case Study Area 5 People's Park (Park Ludowy)
Surface area estimate [ha]	2.65	1.25	1.0	0.31	24
Form of ownership	Public	Public	Private	Public	Public
Year of construction / year of modernization	1823/2017	2015 Continuous change and addition of spaces by different actors	2017	2016	2019
Permanent attractions	Playgrounds Monuments commemorating historical events: 4 pieces	Playgrounds, Gym, Monument to the Sybirak Mother, Mural on the wall separating the square	Seats with panoramic views of the city, Outdoor gym	Viewing terrace	2 large playgrounds, Dog runs, Outdoor gym Workout and fitness area, Acoustic pathway, Didactic philosophical path, Volleyball posts and nets, 3 boules pitches Chess tables
Temporary attractions	Fountain Mulitmedia shows, Concerts, State ceremonies, Christmas decoration, Artistic installations	Art installations, Photography exhibitions	Summer cinema, Café, Playground, summer "beach", deckchairs	Café, Apiary	Didactic water plant garden, Amphitheatre with fountain
Natural elements	High and medium greenery, Annual ornamental plants,	Tall greenery, old trees, lawn, No decorative, No ornamental plants	Green roof: planting of perennials, vines and trees, Partially flat roof	Green roof: planting of perennials, climbers and trees, Partially flat roof	High and medium greenery, natural riparian greenery, Boxes for birds: kingfishers and hoopoes
Number of public seating places	650 seats in total, Different kinds of benches	200 seats in total, 3–4 person benches	c.a. 80 benches additional: possibility of seating on the stairs	No free seats	702 seats in total, 150 park 4-person benches, 24 tables (including 12 with chessboard), 72 chairs, 15 picnic tables, 30 deckchairs
Biologically active area estimated percentage	26% without fountain	c.a. 80%	Green roof – c.a. 70% of total roof area	Green roof – c.a. 70% of total roof area	Over 90%

Background – the role of urban public spaces in the context of Covid-19

Nowadays, the shaping of cities is primarily about the proper provision of friendly public spaces of varied character, forming a continuous system on a city scale. Lorens defined public space as "a fragment of urban space, which – through its location and design – is intended to build direct social contact, while remaining accessible to all [8]". Urban public spaces are characterized by openness, accessibility and transparency [9–14], while aesthetics, testify to the quality of the city and social life [12, 14]. Public space is a part of the city which is used by residents and other users, who perceive its elements and subject it to constant evaluation. A public space is a shared space, which usually has a public owner (state or local government) and is characterized by semiotics that build up spatial identifications, which enable social interaction and communication [15]. However, public spaces are not necessarily public in terms of ownership and management. On the contrary, they can become more "public" when multiple actors – including private ones – are involved in the planning and management of urban areas. Furthermore, private actors can provide the resources needed for the project [15]. From a user perspective, an urban public space can be described as a dedicated area in a city that attracts users, is accessible to them, is aesthetically pleasing, offers opportunities for confrontation, and where people want to meet, feel safe and make social connections.

The emergence of the Covid-19 pandemic was immediately noticed by researchers of public spaces and has raised new issues regarding the utilitarian, functional and sanitary aspects that have a direct impact on design [16–19, 30]. In many cases, there is a need to redesign selected public spaces to ensure safety [12] and also to think holistically about urban management to increase public health [12, 14]. Restrictions on the use of public spaces caused by the Covid-19 pandemic resulted in reduced use of spaces also after the restrictions were removed. Research conducted in the UK has additionally shown a relationship between the socio-economic situation of users and the frequency of use of public spaces. The restrictions exacerbated existing inequalities [15].

Post-pandemic cities are reclaiming public spaces anew. In many ways, measures of containment and physical distancing have contributed to a greater understanding of the importance of public space as a place for gathering and meeting basic social needs. City dwellers are now more aware of the important role of this space as a living environment essential for their physical and mental well-being. The discussion about the contemporary shape of public spaces [16] is also a discussion about the validity of existing paradigms in the field of their design [17]. With a renewed focus on the ability of urban public spaces to stimulate social connectedness and social well-being, our cities can be rebuilt and reconfigured post-pandemic. The enjoyment of public spaces and the attractions they offer can play a key role in this transformation of urban life [18].

The easy and general availability of open green spaces plays a key role in ensuring mental health, which is particularly important in times of pandemic [19].

Creating intimate green spaces [20] and improving the adaptability of streets, squares and semi-public spaces can help to provide a level playing field for all urban dwellers, in terms of improving mental health during pandemics. Multifunctionality seems to be the most appropriate approach in the design of public spaces. In the absence of being able to host specific and especially commercial functions (e.g. mass events, fairs, etc.) these spaces are still able to improve the mental health and comfort of users by continuing other functions, including providing opportunities for physical activity and offering regenerative benefits during lockdown. Greater use of amenities – such as natural elements, pedestrian and cycling infrastructure and urban furniture – and safety in streets and squares can improve the adaptation of these spaces to pandemonium [21].

Negative feelings accompanying confinement to one's own living spaces increase the demand for outdoor spaces. Restrictions and the introduction of social distancing have had the greatest impact on the use of public spaces in recent months. At the same time the use of individual means of transport, including cycling, has increased, and many people have started to walk more, seeing this not only as an opportunity to communicate but also to keep physically and mentally fit.

Background – the role of nature in the quality of contemporary public space

Public space in a modern city has primarily social functions. Scientific research has shown a direct relationship between the aesthetic quality of public space development and the presence of natural elements in it and the

psychological well-being of people, as well as specific behaviours and feelings such as: increased feelings of anger and aggression among drivers driving cars in areas devoid of greenery [22]. The presence of public green space, directly linked to residential zones, is a key element in influencing the quality of life, as well as bridging socio-economic gaps, which is particularly important for children [22]. Jennings and Bamkole [24] point to the relationship between the cultural ecosystem services of urban green spaces, social cohesion (as a social determinant of health) with social and health outcomes. In the case of public green space, there are many studies confirming the direct relationship with its occurrence and the public health status of urban dwellers, but there is still a need to continue these studies [25] and to expand them to include an urban view, allowing us to consider how cities should be shaped in post Covid-19 era [26].

Research shows that being surrounded by greenery or nature is beneficial to human health and psychological well-being [27]. Contact with nature helps to feel and function well [28], increases the sense of life satisfaction, eliminates anxiety, improves vitality, influences creativity, and contributes to increased pro-social behaviour [29] and improved mental health of people [30]. Being in publicly accessible green areas allows for rest, relaxation, relaxation and stress relief, and contact with greenery is a source of pleasure.

Nowadays the use of natural elements in the creation of public spaces is not only a trend, but also an expression of social responsibility. Highly developed industry and technology have led to humans interfering more and more drastically with the natural environment, causing irreversible negative consequences of their actions. Increasing social awareness of nature conservation contributes to the establishment of the concept of sustainable design and the promotion of a healthy lifestyle. One that is no longer just a trend, but a necessity. Urban greenery in urban planning is now treated as a system – green infrastructure, the continuity of which is essential for the proper functioning of the city. Different forms of greenery are desirable, both naturally occurring on undeveloped land, planned and newly introduced [31]. In recent years, there has been an increased interest in urban agriculture and a perceived need to introduce species biodiversity into cities [32]. Flower meadows replacing lawns, urban community gardens, apiaries or allotments are gaining popularity. Many cities (including Lublin) limit the frequency of mowing lawns and street greenery, which is aimed at improving water relations in the city.

Background – the role of art in the quality of public space

The elements of art in urban space have always accompanied man, but their role in the creation of public spaces has varied. Artistic products have decorated and adorned a given place, commemorated history, and evoked various (positive and negative) aesthetic experiences [33]. Nowadays, the multiplicity of art forms allows it to be more widely used in urban spaces and to enhance its social impact [34]. The elements of art in cities can have a purely visual function, often becoming an element of city promotion that attracts tourists [35]. At the same time, art in public space is often used during revitalization processes [36], especially that which provokes the audience to actively participate in it [37]. Different types of artistic works should be counted as additional elements of public spaces, enriching their attractiveness. Art, in permanent or temporary form, gives individual character to particular places by introducing new forms, colours, sounds or materials [40, 41] and enriches the symbolic layer of the city.

Art in public space is not always and has not always been accepted by the public, but it is a barometer of social moods, which can often be interpreted quite differently than the creator intended. Characteristic elements of art give a visual identity to a place, aestheticize it, make it more attractive and above all satisfy the social need to experience beauty [40]. Additionally, they are often good landmarks that distinguish a given space. The inclusion of art in public space makes any environment take on a pedagogical dimension [41].

Art in public space makes public the artwork-receiver relationship, during which contact is made with artistic forms of interference in the spatial fabric of the city [42]. The contact with art leaves traces in the public consciousness, regardless of whether the artwork interested, shocked or bored. Consequently, interactions of a social, cultural and economic nature occur. Aesthetic experiences accompanying the recipient not only consist in reception, but in entering into a relationship with the work of art along with the whole instrumentarium of familiar notions, signs, beliefs, experiences and emotions. We can, therefore, consider art in public space as an important component of culture that goes beyond the classical framework of thinking about artistic creation

and works of art. It is art that demands, conditions and aspires to act. Engaging the viewer generates the potential to create social capital that serves a community of interests, building the cohesiveness of a group of people, thus providing them with identity and security. The possibility to participate in the reception of art in common places not only contributes to the aesthetic value of these spaces, but also triggers in the users the need to share them. Such places quickly become important and frequently visited points on city maps.

Lublin has a long tradition of introducing elements of art into public spaces. In 1976, the first Lublin Visual Arts Meetings were held. The artists who took part in the Meetings enriched the space of housing estates of Lublin Housing Cooperative with works of contemporary art such as open-air sculptures, installations or mosaics and wall paintings on publicly accessible parts of buildings. In the case of Lublin, the city's cultural policy has been significantly visible in recent years. Many of the actions taken during the candidature for the title of European Capital of Culture are continued to this day, which involves the permanent presence of various forms of art in public spaces. Unfortunately, the year 2020 was exceptional – most cultural mass events were cancelled.

Results

Study Area 1: Litewski Square – Multifunctional main square

Since its creation in the 1820s, Lithuanian Square has been one of the most important places on the map of Lublin. Its functions have evolved over time: from a drill square, through a representative square surrounded by official buildings, to being developed as a recreational space after World War II. However, regardless of the time of its existence, it has always been, and still is, a representative space, acting as the city's salon during national celebrations and important cultural events. At the same time, it is an important space of public greenery of great historical significance [43].

Fig. 2. Characteristic elements of Litewski Square. (a) – historical monuments, (b) – fountain, (c) – temporary art installations (Portal to Vilnius – live camera), (d) – pedestrian communication area

The revitalisation works leading to the current shape of the space were completed in 2017 [Fig. 2]. The new development of the square assumed excluding it from vehicular traffic, thus extending the pedestrian route stretching from the castle, through the Old Town and Krakowskie Przedmieście Street, which was excluded from traffic. The existing functions and elements were retained, changing and modernising their architectural forms. The square is divided into two parts: an extension of the pedestrian communication axis towards the old town, which acquires a representative character during celebrations, and the northern part – the recreational part with separate areas for playgrounds, seats and benches, meeting places and greenery. Both parts are connected by the square's greatest attraction – a multimedia fountain. Along the extended part of the promenade there is a series of floor fountains, which diversify the "communication" part of the square. After revitalization, the square has become a meeting place for whole families with children, who often come to Lublin from surrounding towns, because of original playgrounds, interesting and comfortable places for rest, and a colourful and playing fountain. Litewski Square brings many generations together in one place, attracting both residents and tourists of all ages. Among the objections to the current form of the square is the significant reduction in greenery and biologically active area, compared to the time before revitalisation.

Results of the analysis according to Jan Gehl's criteria – chosen elements

During analysis with the aspects assigned to a given criterion Case Study Area 1 received 11 out of 12 possible points.

Protection (2 points)
Litewski Square is completely excluded from vehicular traffic and has restrictions for cyclists. It is a space that flows smoothly into the pedestrian route running through the Old Town. Numerous city surveillance cameras, frequent patrols of the city guard and police, and above all the presence of many participants make this space safe. The problem is the lack of protection against unpleasant sensory experiences, caused by significant felling of large trees and the lack of other forms of roofing.

Comfort (6 points)
The new surface of the square made of smooth granite slabs and wood is comfortable to walk on. All development elements are highly visible. The square has several distinctive defined spots for staying and objects enhancing to stand next to. The large number of diverse seating areas, giving the opportunity to observe the various activities of other users of the space are an advantage. In addition to its permanent recreational functions, the square is a venue for seasonal events.

Enjoyment (3 points)
The square is surrounded by attractive historical buildings, among which public functions dominate. In the northern part of the square, left-over old trees give the opportunity for enjoying positive aspects of climate. Aesthetic quality and fine detailing of small architecture and plants give positive sensory experiences.

Study Area 2: Intimate inner-city square – Square at the Cultural Centre

The space in question is located in the city centre in the vicinity of the renovated building of the Cultural Centre (CK) in Peowiaków Street, approximately 100 m from Litewski Square. The space functions under several names: Central Playground, Lech Kaczyński Square (directly next to the CK building), and Children of Pahiatua Square. It is a small green square formed in place of the former monastery garden. What remains of it is an arrangement of old trees [Fig. 3].

The square has several zones: a green recreational zone with tall trees and benches, a separate playground and gym, and a paved area around the historic shrine of Christ the Sorrowful, located at the main entrance to the Cultural Centre building. All these zones are linked by permanent or temporary art elements. They are very diverse: from the already mentioned historic baroque chapel, through the martyrological monument to

Sybirak Mother, the concrete cubes which gain a different appearance every year, numerous temporary sculptural installations, to the mural on the wall marking the northern border of the square. The so called Central Playground uses different textures and colours of surfaces for walking, roller skating, skateboarding or cycling, interspersed with lawn strips and benches. The extreme part of the square features a sculpture in the form of a huge red hand embracing a tree trunk (authors: K. R. Filipowski, P. Pawluk, K. Czosnyk, T. Wojna, 2018). A year later, artistic installations by Anna and Irena Nawrot "Nests" appeared on the trees around the CK. The friendly public space of the square, its intimate character, different from that of Litewski Square, attracts residents, providing an attractive place for children, young people as well as the elderly. At the same time, the wooded part of the square is often visited by alcoholics and the homeless.

Among the public spaces surveyed, the square is characterized by differences in public perception. The users perceive it as indifferent, negative (boredom, dislike) as well as arousing interest. The degree of the latter emotion is the highest in relation to all surveyed spaces, which is connected with its greatest changeability, caused by artistic activities taking place in this space. An example is the installation by K. Stańczak "Background of Events" [Fig. 3 a]. The art installation was realized in 2018 as part of the 10th Open City Art in Public Space Festival 2018. The work referred to architect Oscar Hansen's postulate to organize architecture and public space according to the Open Form. It is a loose reference to Katarzyna Kobro's Spatial Form IV from 1929. Its integral and inseparable part are, among others, skaters who break the stability of the artistic form with real movement.


a)


b)


c)


d)

Fig. 3. Characteristic elements of Square at the Cultural Centre. (a), (b), (c) – temporary art installations, (d)– Lech Kaczyński Square

Results of the analysis according to Jan Gehl's criteria – chosen elements

During analysis with the aspects assigned to a given criterion Case Study Area 2 received 8 out of 12 possible points.

Protection (1 point)
The square is isolated from vehicular traffic. Due to the presence of alcohol drinkers and homeless people, the sense of personal safety may be low. Outside the crowns of tall trees, there is a lack of elements to protect from the sun or rain.

Comfort (5.5 points)
The varied nature of the square means that the area offers a variety of attractions for users, but there is a lack of attractions during the winter period.

Enjoyment (1.5 points)
The buildings surrounding the square are of varying public accessibility and architectural quality. The aesthetics of the landscaping elements leave much to be desired, but they are functional.

Study Area 3: public space accompanying the commercial function – shopping mall roof

The arguments in favour of the positive impact of nature on people have contributed to the increasing use of green roofs with plants by architects, which are often the only alternative to introduce a bit of greenery to densely built-up cities. They are also an appropriate solution from the point of view of improving the urban microclimate and retention of rainwater. One such example is the Vivo shopping centre building in Lublin (designed by B. Stelmach and Partners). The building combines the maximum use of investment opportunities for a large-scale commercial building with the need to protect the panoramic view of the Old Town hill, and ecological aspects, which involved introducing the development into green areas. When designing this building, the architects took into account the context of cultural heritage, surrounding nature and location – in the city centre with a view of Lublin Castle. In this case, the green roof resulted primarily from conservation conditions, but became an attractive public space [Fig. 4].

The partially designed public green roof with paths and benches proved to be an effective way to attract residents. It allows people to meet in the outdoor green space and enjoy both the distant views and the interestingly selected plants on the roof itself. In the summer, the space is enriched by additional functional attractions: a beach, cafés, a playground or a summer cinema. The flat roof has become part of the system of urban public spaces, even though it is part of a private, commercial building.

Results of the analysis according to Jan Gehl's criteria – chosen elements

During analysis with the aspects assigned to a given criterion Case Study Area 3 received 4.5 out of 12 possible points.

Protection (1 point)
The roof is accessible both from inside the shopping mall building and from the outside, with both access routes periodically closed by the manager. In case of unfavourable weather conditions the area is not well suited for outdoor activities.

Comfort (2 points)
The space is attractive mainly because of the panoramic views of the city. In summer the recreational offer is enriched by temporary attractions, which increases the number of visitors. However, the existing benches are insufficient for a larger number of users. In autumn and winter the terrace is closed.

Enjoyment (1.5 points)
The scale of the building does not allow this space to be defined by its attractive edges. The most important aesthetic experiences are the distant views and the high quality of the plant selection and landscaping elements.

Fig. 4. Characteristic elements Galeria Vivo roof – public function on commercial building, (a) –view in the direction of the castle hill, (b) – main and side stairs form the ground level to the roof, (c), (d) – upper terraces

Study Area 4 public space accompanying the cultural function – the roof of the Meeting of Cultures Centre "Sky Terraces"

The roof of the Meeting of Cultures Centre in Lublin is another example of a new public space using elements of the natural environment. The modern edifice of the building was created on the basis of the so-called 'Theatre under Construction' – a structure that had remained unfinished since the late 1970s. The CSK building was put into use in 2014, but the increase in the popularity of the public space on the roof observed over the last 5 years is related to the development of vegetation. The Meeting of Cultures Centre, by design, is intended to be a place where different cultures coexist, thus upholding Lublin's tradition as a city on the borderline of cultures. The ECC is intended to be a place of dialogue and meeting place for cultural and intellectual matters in

Central and Eastern Europe [44]. In this context, the "Sky Terraces" offer the possibility of admiring the panorama of Lublin's downtown for free, with the most important parts of the city and its multicultural tradition visible.

The CSK building is located in the city centre opposite the oldest city park – the Saxon Garden. Its location creates a pretext for an architectural statement different from the standard one, while in the immediate vicinity a sequence of public spaces of different scale and character is created: the square in front of the front façade is a multifunctional "stage" and auditorium at the same time. The façade on this side of the building is clad with glass with a very low iron oxide content, which ensures high light transmission. The glass used in the construction provides greater light transmission, thus creating brighter interiors, protecting against heat loss and enabling complete privacy.

The accessible areas of the roof of the CSK building are located on two levels: +4 housing a café, a nature trail and an urban apiary, and +5 being the viewing terrace. Access to these spaces is possible during the opening hours of the institution and is provided by lifts from inside the building. Both levels offer spectacular views of the surrounding city centre. On the roof, there are glass tunnels where one can walk around admiring native plant species typical of the Lublin region, shrubs and fruit trees planted there. On the roof of the building there is a summer educational path dedicated to ecology and nature. The translucency of the glass and the substrate (steel grids) means that not every user feels comfortable in this space. Through the use of individual technical solutions, a sense of lightness and naturalness has been achieved in the context of the urban fabric. By combining the contemporary possibilities of glass with elements of nature, it becomes authentically present in the urban space and in the consciousness of its inhabitants [Fig. 5].

Fig. 5. Characteristic elements of the roof of the Meeting of Cultures Centre "Sky Terraces" (a) – arrangement for temporary attraction, (b) – entrances and glass tunnels, (c) – main walking path, (d) – general view

Green roofs, which are often a rational necessity in densely built-up urban environments, can become fully-fledged public spaces. The examples studied in Lublin show that their popularity is determined mainly by

accessibility and the quality of the view links. In the case of Lublin, publicly accessible green roofs are still rare, but both legal conditions and the growing awareness of designers and investors give hope for their wider use. If properly designed, they can become valuable natural and social spaces: they reduce the level of pollution in the environment, protect against noise, improve air quality and microclimate, which is important for the health of residents. Thanks to such solutions, cities gain cleaner air and their inhabitants additional areas for recreation.

Results of the analysis according to Jan Gehl's criteria – chosen elements

During analysis with the aspects assigned to a given criterion Case Study Area 4 received 5 out of 12 possible points.

Protection (2 points)
The roof is accessible only inside the building by lifts. Users are constantly "accompanied" by surveillance cameras. In case of unfavourable weather conditions the area is not suitable for staying.

Comfort (2.5 points)
The space is attractive mainly because of the panoramic views of the city. Many people find it uncomfortable to move inside the glass tunnels with the transparent floor. The traffic surface is not conducive to wearing smart shoes. There is a lack of places to sit and stop. Most of the temporary attractions have to be paid for. The terrace is closed during autumn and winter.

Enjoyment (0.5 points)
The scale of the building does not allow this space to be defined by attractive edges. Distant views and high quality plant selection are the most important aesthetic experiences. There is a lack of small architectural elements, although the architecture of the building itself is outstanding.

Stud Area 5 – city park. People's Park (Park Ludowy)

The People's Park is part of a system of publicly accessible green areas associated with the valley of the Bystrzyca River. In the interwar period, a horse racing track was created adjacent to the popular urban river beach, and areas of the Bystrzyca meadows in the vicinity of the city centre were identified as potential sites for fairs, exhibitions and mass recreation. In the post-war period, plans were continued by locating sports facilities and planning a system of parks of peri-urban importance, of which only Park Ludowy was realised. The flood hazard and periodic flooding of the wide valley prevented full use of the recreational potential of the meadows until 1976, when the construction of the Zemborzycki Reservoir was completed.

The People's Park, covering an area of about 28.5 hectares, was created between 1950 and 1957 on wet meadows on the Bystrzyca River. Its composition refers to baroque solutions, which was a popular solution during the Socialist Realism. A characteristic element of the layout was an axis ending in an amphitheatre.

The construction of the park was connected with the new political situation – emphasising the idea of the People's Republic of Poland through the participation of residents in the construction as part of community work. At that time the attractions included an airplane-café, an amphitheatre and a traffic town. The park functioned quite well until the 1980s, when it began to deteriorate. At that time, the trees began to die due to the waterlogged ground, excessive growth of low plants, which, combined with the cessation of upkeeping works, soon brought the place to a state of extreme neglect. The trees were also badly affected by the vicinity of the Lublin Sugar Refinery, which stored sugar beet flotation waste in the park. In the 1990s, a permanent funfair operated in the park, but this did not improve the public perception of the People's Park, which was regarded as neglected and dangerous.

At the beginning of the 21st century, in the southern part of the park, the hall of the Lublin International Fair (now Targi Lublin S.A.) was located, which introduced a new function to the area.

In 2011, the expansion of the trade fair complex began. The new hall (8,000 m^2), the construction of which took up a large part of the park, blurred the parks original composition. Plans to build an educational and scientific centre called "Eksploratorium" in the People's Park were not realised by the city. In 2012, in response to the gradual development of the park, a social concept for the development of the People's Park was created, which indicated the current needs of users and showed examples of solutions. The concept was prepared in a public consultation process that included a series of open meetings and workshops, and designs made by students of Catholic University of Lublin and University of Life Sciences in Lublin, presented during a public discussion. In 2015, a social concept for the revitalization of the park was created, which was taken into account by the designers. The construction project itself was also subject to public consultation. The current shape of the park is the result of revitalization works that took place between 2019 and 2020.

Before the renewal works, the People's Park was included in the group of "semi-open parks (share of tall vegetation from 25 to 50%), in which the ratio of tall and medium vegetation is balanced with meadow and grassland areas" [45]. Before revitalization, the area was rated negatively by users due to dilapidated fixtures, neglected greenery and lack of attractions.

The revitalized park was opened in XII 2020, but interest in it peaked after the removal of sanitary restrictions in May 2021.

Fig. 6. Characteristic elements of the the People's Park (a) – new pedestrian and bicycle bridge, (b) – fountain and the main composition axis, (c) – one of the playgrounds, (d) – chess area

The revitalization of these areas has made it possible to create a place for active recreation, providing a wide range of recreational opportunities for different age groups [Fig. 6]. The redevelopment included comprehensive greenery management, the creation of gardens and nature trails, a rest area, playgrounds, a gym and walking and cycling routes. In order to maintain harmony with the surroundings, the playgrounds were made of wood. The equipment in the physical activity zone is designed for different groups of users, regardless of experience and level of advancement. In addition, the area is equipped with volleyball posts and nets,

and a separate area for playing boules. All recreational facilities and paths are accompanied by visual information elements in the form of boards. A didactic water garden in the form of an amphitheatre with stands and a basin has been introduced in the central part of the park. The greenery surrounding the garden has been supplemented with elements of small architecture, which promote calm and contemplation. There is a path of the processes of passing, which consists of plants in various stages of life. Another element accompanying the walking alleys is a didactic philosophical path consisting of specially designed free-standing granite forms which may serve as seats or as decorative sculptures. Their location also favours their use by roller-skaters and cyclists as terrain obstacles. Due to poor ground conditions, a drainage system was built under a large part of the area: rainwater is drained into a drainage ditch, from where it is directed to a pumping station and a river.

During the redevelopment, the previously existing trees were left in place and new trees, shrubs, ivies and ornamental grasses were planted. The didactic garden was planted with aquatic plants typical of this region of the country. Old trees, trunks and broken boughs left behind are intertwined with newly planted plants to form exhibits of plants in various stages of life. The greenery in the park area is varied and includes both densely wooded areas and open spaces. The highest density of trees is found in the northern and north-western part of the park, where there is a large number of self-seeders, forming dense and unplanned clusters.

Results of the analysis according to Jan Gehl's criteria

During analysis with the aspects assigned to a given criterion Case Study Area 5 received 11 out of 12 possible points.

Protection (2.5 points)
The high number of users and the discreetly placed monitoring and lighting promote a feeling of security.

Comfort (5.5 points)
High saturation of attractions is conducive to both active and passive leisure. The traffic surface is very comfortable. There is no shortage of places to sit.

Enjoyment (3 points)
High quality solutions of landscaping elements. Accessibility to natural water (river) as well as in the fountain are the greatest values

General Results

Studies of spaces according to Jan Gehl's criteria indicate that most of them are fulfilled in the case of Litewski Square and Ludowy Park – spaces whose construction was proceeded by public debates, contests and media publicity. A relatively high assessment was given to the square next to the CK, which arouses the most controversy in the assessment of users' perception. The public spaces created on the roofs scored very poorly according to the Jan Gehl criteria, receiving less than half of the possible points. In the opinion of the authors, this shows that this method is not suitable for the assessment of spaces such as green roofs, as these spaces were ranked relatively high in the user evaluation survey [Fig. 7]. Perhaps a different tool should be developed for the assessment of green roofs, as the user assessments show that they can compete with squares and parks, i.e. traditionally shaped public spaces.

The results of the survey indicate that the most popular public space for leisure activities in Lublin is the People' Park (36%), which has a fairly large green area, deckchairs and benches for relaxation, playgrounds for children and young people, a gym and creative facilities. It was followed by the roof of the Galeria Vivo (27%), Litewski Square (16%), the roof of the Meeting of Cultures Centre (15%), and the square in front of the Cultural Centre (6%) [Fig. 7].When choosing a space, respondents were mainly guided by "the atmosphere of the place" (30%), "equipped with small architectural elements" (22%), high aesthetic value of the space (21%), and "the atmosphere of the place" (21%), "high aesthetic value of the space" (12%) "condition of greenery" (11%)

and provision of elements for active recreation and play (11%). The subjective assessment of these three criteria makes it possible to underline the importance of greenery, aesthetics and the quality of the landscaping elements in the overall assessment of the space, while at the same time being translated into objective figures.

Table 2. The results of spatial analysis with the use of Jan Gehl's 12 criteria for the quality of livable public spaces

PROTECTION 0–3	**Elements analyzed:**	**Protection against vehicular traffic (0–1):** Traffic accidents; Pollution fume, noise; Visibility	**Protection against crime&violence (perceived safety) (0–1):** Lively/Active Street life Passive Surveillance Overlapping functions in space and time	**Protection against unpleasant sensory experiences (0–1):** Wind/Draft Rain/Snow Cold/Heat Pollution Dust/Glare/Noise
	Case Study 1	0.5	1	0.5
	Case Study 2	1	0	0
	Case Study 3	0.5	0.5	0
	Case Study 4	1	1	0
	Case Study 5	1	1	0.5
COMFORT 0–6	**Elements analyzed:**	**Possibilities for Walking (0–1):** Room for walking; Accessibility to key areas; Interesting façades; No obstacles; Quality surfaces	**Possibilities for Standing/ Staying (0–1):** Attractive edges – "Edge effect"; Defined spots for staying; Objects to lean against or stand next to	**Possibilities for Sitting (0–1):** Zones for sitting; Maximize advantages – pleasant views, people watching; Benches for resting
	Case Study 1	1	1	1
	Case Study 2	1	1	1
	Case Study 3	0.5	0	0
	Case Study 4	0.5	0	0
	Case Study 5	1	1	1
	Elements analyzed:	**Possibilities to See (0–0.5):** Distances to objects; Unhindered views; Interesting views; Lightening when dark **Possibilities for hearing talking (0–0.5):** Low ambient noise level; Sitting arrangements conducive to communicating	**Possibilities for Play / Recreation / Interaction (0–1):** Allowing for physical activity, play, interaction and entertainment; Temporary activities (markets, festivals, exhibitions, etc.); Optional activities (resulting, meeting, social interaction)	**Day and Night activity (0–0.5):** 24 hour city; Variety of functions throughout the day; Light in the windows (residences); Mixed-use; Lighting in human scale **Seasonal activities (0–0.5):** Seasonal activities; Extra protection from unpleasant climatic conditions; Lightning
	Case Study 1	1	1	1
	Case Study 2	1	1	0.5
	Case Study 3	1	0	0.5
	Case Study 4	1	0.5	0.5
	Case Study 5	1	1	0.5
ENJOYMENT 0–3	**Elements analyzed:**	**Scale (0–1):** Dimensioning of buildings and spaces in observance of the human dimensions related to services, movements, size and behavior	**Possibilities for enjoying positive aspects of climate (0–1):** Sun/shade Warmth/coolness Breeze/Ventilation	**Aesthetic quality/positive sensory experiences (0–1):** Quality design and fine detailing; Views/ vistas; Trees, plants, water
	Case Study 1	1	1	1
	Case Study 2	0.5	0.5	0.5
	Case Study 3	0	0.5	1
	Case Study 4	0	0	0.5
	Case Study 5	1	1	1

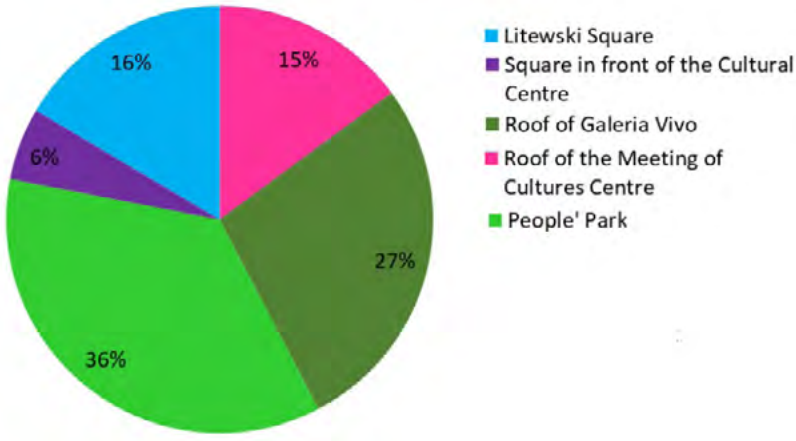

Fig. 7. Diagram illustrating the user's perception of the selected spaces based on the questionnare

The most subjective to define, and at the same time crucial for the assessment of the quality of public spaces, was their atmosphere. Respondents were asked to indicate the emotions accompanying their stay in the surveyed public spaces. The choice was up to 3 emotions/feelings, both positive, negative and ambivalent. The majority of the surveyed spaces were dominated by positive emotions such as: pleasure, satisfaction, admiration, curiosity, and calmness. Among the negative ones the respondents could indicate: anger, irritation, confusion, dislike, boredom. Additionally, it was possible to indicate indifference. Each of the surveyed spaces was tested for the occurrence of these emotions. It should be noted that the occurrence of positive emotions coincides with the high rating of atmosphere as one of the criteria for the subjective evaluation of the space. Among the emotions, pleasure and satisfaction dominated. The greatest diversity of emotions accompanying the perception of space was indicated by respondents in the case of Square at the Cultural Center. Among the emotions accompanying its reception, the following were indicated: indifference (20%), aversion (16%), satisfaction (18%), pleasure (15.5%), boredom (13.5%) curiosity (11%), admiration (5%), peace (2%) [Fig. 8].

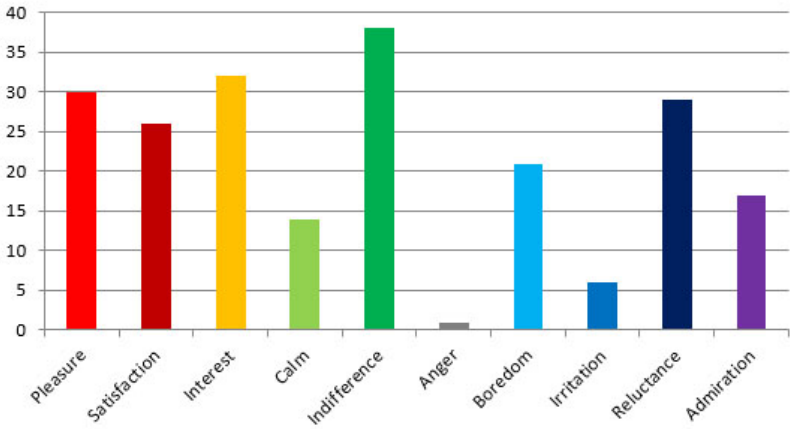

Fig. 8. Diagram illustrating the diversity of emotions accompanying the perception of space Square at the Cultural Center

The respondents were asked to indicate up to 3 elements which determine the attractiveness of the evaluated public spaces or have an influence on its enhancement. The most frequently indicated elements were the presence of greenery 115 out of 150 responses, outdoor cinema 100 out of 150 responses, elements of small architecture 84 out of 150 responses, places for rest 81 out of 150 responses, lighting 86 out of 150 responses, community gardens 76 out of 150 responses, temporary exhibitions 55 out of 150 responses and elements of art 41 out of 150 responses [Fig. 9]. Obtaining such a high rating for the idea of an outdoor cinema may be relevant to the current post Covid-19 situation.

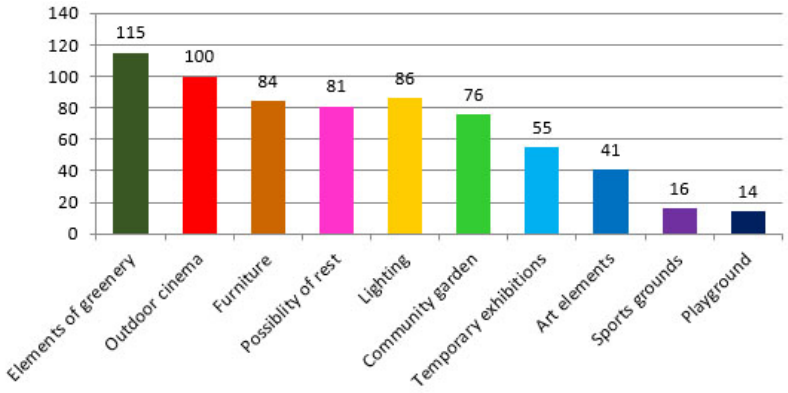

Fig. 9. Diagram illustrating the most desirable elements overengineering public space

The lowest ranked space among the proposed spaces was the Case Study 2 – square at the Cultural Centre (CK) (33%), where a large number of respondents did not choose this space because of the lack of a sense of security (18%), the poor aesthetics of the space (15%) and because of not well-kept greenery (28%). These features were also the most frequently chosen answers when indicating the weakest spaces. The most common emotions experienced while staying in the least chosen spaces are indifference, aversion, boredom and irritation. In turn, the most frequently experienced emotions when staying in well-designed spaces are pleasure, delight, peace and contentment.

The majority of respondents (92%) felt that elements of art in the urban space increase the attractiveness of the place and play an important role in social life. When it comes to the reception of street art, curiosity and admiration were the most frequently chosen answers in terms of the type of emotions evoked [Fig. 10]. As many as (87%) respondents believe that elements of art can play a significant role in the revitalisation of urban spaces. Most respondents (88%) agreed that art is able to satisfy human needs not only in terms of aesthetic and visual, but also psychological and social aspects.

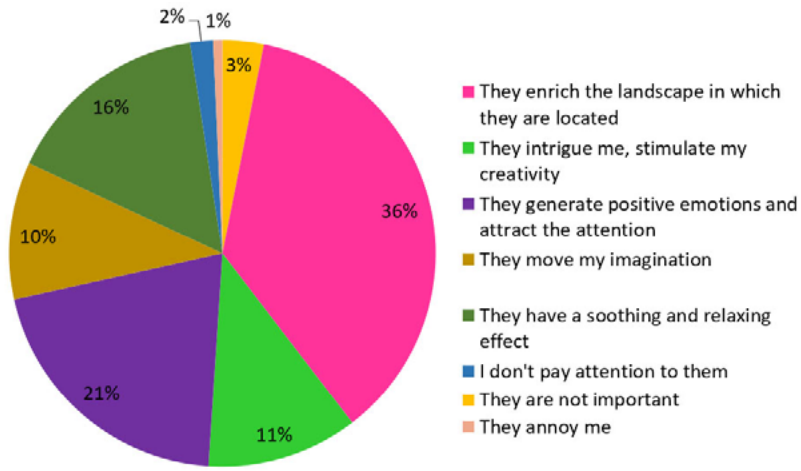

Fig. 10. Diagram illustrating the importance of art elements in public space

The data analysis of the survey results shows that only a part of the analyzed public spaces in Lublin selected for the survey fulfil the functions expected by their users. Only those spaces which contain a lot of greenery, places for play and rest, and elements of art are frequently visited. the city's public spaces, which were selected for the study, fulfil the functions expected of them by their users. only those spaces which contain a lot of greenery, places for play and relaxation as well as elements of art are frequently visited.

The People' s Park, which was voted the best public space by the respondents, is a space where users have to go with purpose (it's not a space that one passes by). Its location in a sequence of recreational and sports areas along the Bystrzyca valley is conducive to active leisure. To a large extent, this space meets the basic needs of its users, as it contains comfortable places for relaxation, opportunities for gymnastics, interesting

places for children to play, numerous ramps and paths for scooters and roller skates, and a separate area for playing chess and boules. It is probably the first place in Lublin that can provide various attractions at the same time, regardless of the age of users.

In spite of the imperfections of the selected spaces in Lublin, they are very often visited by the inhabitants who often struggle with the lack of green areas in the closest vicinity of their residence. The research carried out, on the one hand, shows what is most interesting, what attracts people and encourages them to visit a given space. On the other hand, it reveals certain imperfections and shortcomings which influence the perception and frequency of visiting a given place. Among the spaces selected for the study, each of them has certain shortcomings and imperfections, as some lack greenery, others comfortable places for relaxation, and still others creative-artistic activities. All this influences the positive or negative perception of a given space, which is reflected in the number of visitors. Man feels good among greenery, in a place where he can rest comfortably and calmly. On the other hand he constantly needs contact with other people, in a place which is aesthetically pleasing, functional, where he feels safe and which meets his expectations also from a psychological point of view.

The needs of society are constantly changing, and therefore public spaces should not be regarded as finished, but should be open to the possibility of making changes and experimenting with the needs of the residents [46].

Conclusions

The design of high quality and attractive spaces is an important element of urban renewal. This type of activity leads to an increase in the quality of life, creates image-attractive cities and attracts residents and tourists. In the latest realizations of public spaces in Lublin, the influence of the design methodology of prof. Jan Gehl is noticeable. To the greatest extent it concerns the realization of the People's Park, the design of which was created in close cooperation with city activists and the process of social participation was really real. This area was rated highest by users and became new landmark in the city.

Livable urban public spaces should be diverse, original, safe and heterogeneous, so as to provide comfort and recreation for the inhabitants and all users. The combination of elements of nature, art and good quality landscaping, creates an inextricable link with the past and influences their development. Very often livable public spaces are the most characteristic urban spaces, which due to the functions they perform, and their identity become landmarks and therefore eagerly visited by residents and tourists.

The analysis presented reveals that public space in cities is not only an area where residents and tourists can potentially meet, but is much more than that, as it has a direct impact on lifestyles. Undoubtedly, well-designed public spaces, where various social activities take place, influence the social character of the city and its inhabitants [47].

In view of the emergence of new forms of public space such as green roofs, there is a need to develop a methodology for their assessment in terms of quality criteria, as the classical approaches do not take into consideration their specific features. Green roofs or other spaces often associated with commercial facilities can be attractive public spaces and competitive with traditional squares or parks.

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Voice in the discussion about the original architecture of the Powder Tower and the 16th century third defensive line in the Lviv middletown

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Abstract: The Powder Tower was an integral part of the third defensive line, which was laid around the Lviv City Centre since 1522. The active phase of construction of the third line begins after 1527 (the Great Fire of Lviv) and continues until the end of 1540. Construction took place during twenty years when the city was exempt from paying taxes to the state royal treasury and could spend money on the modernization of fortifications.

In the article, we prove that the date of its construction should be considered 1522–1535 based on the analysis of the defensive parameters of the Powder Tower, its architectural and typological characteristics. Although in the literature most often we can find that construction of the tower was conducted in 1554–1556. In my opinion, at this time there could only be some kind of modernization of the building – the construction of an additional last tier, covering galleries or installing a roof over the entire building. A defence facility of such cubic capacity could not be built in 2 or 3 years. Therefore, given the Great Fire in the city in 1527, the following dating scheme looks very logical: the beginning of work – in 1522, completion – in 1535 and modernization – in 1554–1556.

The environment around the Powder Tower, in addition to the extraordinary value of architectural space, has preserved archaeological remains of a unique complex of fortifications of the XIV-XVI centuries. Improvement and and architectural and landscape transformations of the territory around the Powder Tower should be considered as a complex regeneration of the eastern side of the fortifications of the Lviv city centre, which consisted of three defensive lines: a High wall (from the port Ruthenica, Mulyarska and Rymarska towers), a Low wall with three small bastei, the Third belt of fortifications. Unlike the Low wall, the third defensive line of artillery bastions surrounds the city centre on all four sides.

The third belt of fortifications had constant phases of modernization and reconstruction. After its construction in 1522–1540 and modernization in 1554–1556 and further reconstruction of its individual objects took place. For example, in the eastern part of the third line: the north-eastern rondel eventually became the Royal belleward; the empty Powder Tower at the beginning received the upper tier with machicolations, and later the roof; the Carmelite entrance was gradually transformed due to the standards of the defensive gate; the triangular bastei was rebuilt into a "fifth-form" bastion; the Royal Rondel in the south-eastern corner of the defensive belt received a high upper part.

Keywords: defensive architecture, XVI century, Lviv, Powder Tower, third defensive line

Introduction

Lviv historian Franciszek Jaworski, in a study of the Powder Tower published in 1905, extremely aptly noted that in no other corner of old Lviv can you feel the specific Lviv charm and ancient atmosphere, as being near the Powder Tower [6, p. 11]. In this unique place, the landscape is dominated by historical buildings that refresh memories of past centuries – the Kornyakta Tower, the Assumption Church, the dome of the Dominican

monastery, the royal and city arsenals, the silhouette of the Church of the Carmelites, The Church of Candlemas, the King`s Arsenal and the City Arsenal, the palace of Catholic archbishops, the Church of St. Casimir, High Castle, buildings of Shevchenko Scientific Society, "Dnister" society, first Austrian gymnasium, and governorate. A whole crown of iconic historical buildings in Lviv. This place is a real architectural pearl of Lviv.

In the 1970s, in the Lviv cultural environment (in particular, in the Powder Tower, where was located Architect's House – the place of meetings of architects and artists), a "perception of the architectural environment and its emotional and artistic potential" was a popular topic of theoretical architectural discussions. These discussions were conducted by Igor Seredyuk, dean of the Faculty of architecture, and Viktor Kravtsov, associate professor, who often opposed him [2]. Experiments were conducted among students to "measure" the emotional potential of streets and buildings. We would like to bring these discussions back to the present time – the full commercialization of architectural thinking and find out if there is an awareness of the exceptional value of the Powder Tower along with its surroundings.

Today, the environment around the Powder Tower has completely lost its integrity. Chaotic tree plantings have obscured the view of neighboring monuments. The playgrounds created here have completely leveled the traces of ancient earthen fortifications. Parking for buses and cars is at odds with the historical potential and recreational opportunities of this space. Being here you do not feel at all that the building of the Powder Tower was part of a unique system of fortifications of the 16th century.

Therefore, the purpose of our publication is to shed light on the history of this place – the powder tower and the system of fortifications, as well as to justify the need for restoration and rehabilitation measures for the tower and its surroundings.

Research and discussions

The Powder Tower was part of the third defensive belt of the eastern part of the fortifications of the Lviv city centre (middletown). We emphasize on the correctness of the term "tower", although, by the rules of fortification architecture, this type of building is intermediate between the bastei and the tower. Nevertheless, the term "tower", which has recently been used for the name of the object, is not correct from the point of view of military architecture. The original shape of our object had typical features of the bastei, and later, when its internal space began to be blocked, it became known as the tower.

Fig. 1. The Powder Tower in Lviv. Photo: [12] uk.wikipedia.org/wiki/porochova_vezha.

Fig. 2. The model reconstruction of the Powder Tower for the period of the XVII century by J. Witwicki [18]

The eastern part of the fortifications of the city centre was the most compound defensive complex, due to the peculiarities of the topography of the area and the greatest potential danger of enemy attacks from this direction. Trying to reconstruct the stages of development and architecture of this complex, you immediately

realize that it is a unique example of fortification art not only in Lviv but also in the cities of Eastern Europe. The complex of structures in this part was developed during XIV-XVIII centuries according to the traditional scheme: at each new stage existing fortifications were modernized and a new external belt was added. As a result, a specific complex of fortifications appeared and developed on the eastern side of the city centre, which consisted of five defensive lines.

The Powder Tower was an integral part of the third defensive line, which was laid since 1522. The active phase of construction of the third line begins after 1527 (the Great Fire of Lviv) and continues until the end of 1540. This is the period when the city receives a tax exemption. The date of construction of the Powder Tower is not fully clarified. Researchers W. Tomkewicz and J. Witwicki, who most deeply studied the history of the construction of Lviv fortifications, date the construction of the tower to 1522–1535 [15; 18]. The researcher of Lviv V. Vuytsyk also agrees with the date of 1522 as the beginning of construction [19]. But other historians often give the date 1554–1556 – T.Trehubova, R.Mykh [16], I. Krypiakevytch [7], O.Czerner [3]. This date is also presented in the four-volume book on monuments of urban planning and architecture of the Ukrainian SSR, the only illustrated catalogue-reference book about the architectural heritage of Ukraine [8].

Given the defensive features of the tower, its architectural and typological characteristics, I cannot agree with the dating of its construction in the 1550s. At this later time, in my opinion, there could only be some kind of modernization of the building – the construction or modification of an additional last tier, covering galleries or an entire building with a roof, or some other work. Here are several arguments in support of the earlier date of construction of the building.

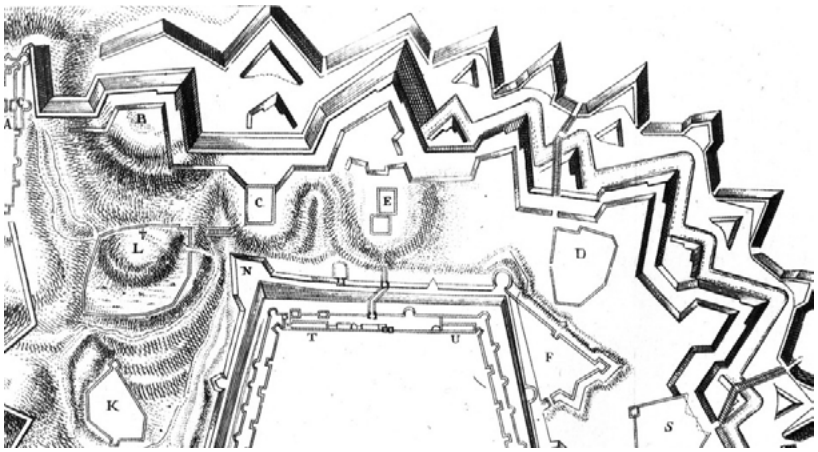

Fig. 3. Fortification lines of the eastern part of the fortifications of the Lviv city centre in the project drawing of Y. Behrens in 1678. The project provided for the construction of a fourth bastion defensive line around the city centre. In addition to the detailed opening of the belt from the new bastions, the project has the designation of old defensive fortifications, in particular, the Powder and Strumilova bastions. The project also provides for the reconstruction of the so-called Royal semicircular bastei in the third line into a pentagonal bastion (Behrens designated it with the letter „N").

A defence facility of such cubic capacity could not be built in 2 or 3 years. Therefore, given the Great Fire in the city in 1527, the following scheme of dating the construction of the Powder bastei looks very logical: the beginning of work – 1522; 1527–1528 – a break due to the fire of the city; 1529 – resumption of work and its completion in 1535; modernization of the tower – in 1554–1556. The main argument for such dating, in addition to the information given by W. Tomkewicz, we consider the urban-fortification factor. It is known that in 1522 the city began to build simultaneously along the entire length an additional third line of defence on the southern and eastern sides of the city centre. This line consisted of a rampart scarped outwards, a wide ditch and large basteis made of stone in several tiers, which were placed at intervals of 100–200 m. This line of defence was more advanced than the small basteis and towers of the Low wall and was focused on the use of artillery and hand firearms, plenty of which there were in Lviv at that time [15: 104]. The main role in this line was played by powerful basteis equipped with cannons. These basteis were round or horseshoe-shaped and were large stone two – or three-tiered objects. Sometimes, if they had a round plan shape and protruded somewhat beyond the front of the wall, they were called rondels. The кondel type includes the Royal corner bastei of the third defensive belt of Lviv. The beginning of the use of this type of fortifications should be associated in Lviv with the construction of barbicans at the Krakow and Galician gates at the beginning of the XVI century. In general, the construction of such a high type of basteis appears in the second half of the XV century in Italy, and the theoretical justification is found a little later in the work of Albrecht Durer [5].

In Lviv, eastern and southern horseshoe-shaped basteis were being built simultaneously. Imitating Durer's concept, they are placed in the middle of the parts. Southern bastei is known as Strumylova or Strumylka (Strumilka). The eastern one will later be called the Powder Tower. The Strumylka is identical in plan configuration and size to the Powder one. The width of the first is 19.5 m, the second has 19.5 m as well. The shape in the plan of both objects is also identical. Both objects originally had an "empty" interior, open towards the centre (Fig. 3, 4).

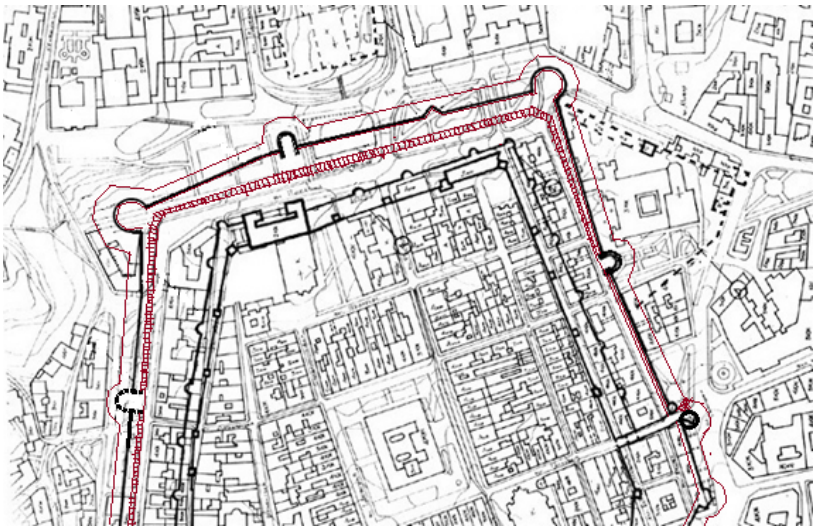

Fig. 4. Hypothetical reconstruction of the planning structure of the three lines of the eastern part of the Lviv fortifications as of the beginning of the XVI century (1522–1540), performed on a modern background (M. Bevz, 2020)

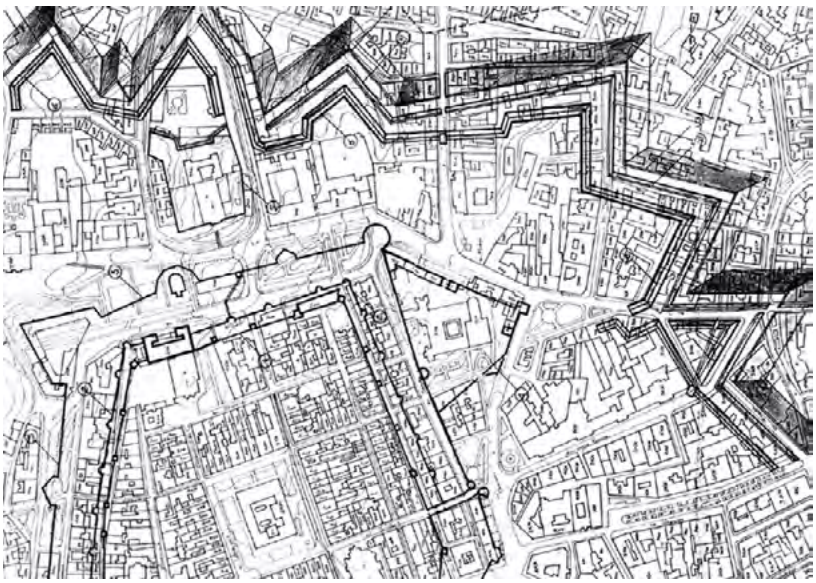

Fig. 5. Hypothetical reconstruction of the planning structure of the four lines of the eastern part of the Lviv fortifications as of the end of the XVIII century performed on a modern background (M. Bevz, I. Okonchenko, 2007) [1]

The city had the greatest expenses on the construction of fortifications in 1529–1532. The list of works that were carried out at that time includes the restoration of the gate and work on the Powder Tower, Shevska and Kramarska towers [15: 108]. Italian influences in the construction of Lviv fortifications in the 1520s were noticed by Tomkiewicz [15: 106], noting that the proposed flanking basteis were known from the works of Leonardo Da Vinci and Michelangelo and were already implemented in the early XVI century in the cities of Padua and Ferrari. Padua was a part of the Republic of Venice, and Lviv's ties with Venice were actively developing at this time.

Fig. 6. Plan of the central part of the Lviv city since 1780 by Fr. d'Ertel [10] (photocopy, M. Bevz). The Powder Tower by mistake is drawn faceted at the plan, covered with a roof, in contrast to the "empty" Royal bastei at the southern end of the third defensive line. To the left of the tower, the A-B line indicates the intersection along the defensive rampart and ditch. This cross-section is presented at the following illustration.

Fig. 7. Drawing of the intersection along the rampart and ditch next to the Powder Tower, which is presented on the plan of the central part of the city of Lviv since 1780 by Fr. d'Ertel [10]; (photocopy, M. Bevz). You can see that the plan was implemented to modernize the fortifications of the third line. The width and profile of the rampart are planned to be reduced; the projected rampart body is painted over. From the cross-section (A-B) designations, we can see that the height of the scarped wall of the defensive rampart reached 4 m, and the ditch was quite deep and had a stone counterscarp about 2 m high.

At the ends of the southern part of the fortifications of the third line, basteis are being built – the Royal Rondel (the corner with the eastern part, now its archaeological remains are located under the roadway of the street near the building of the city Department for the Protection of the Historic Environment) and the so-called Vuzheva (south-western corner).

At the northern end of the eastern part of the third line, a circular bastei is first built, similar to an architecture of the Royal one. In 1672, in the project of building new fortifications of J. Behrens, it was planned to modernize it into a bastion form. It was carried out in 1685, when, on the instructions of Y. Sobieski, this bastei was radically rebuilt into a bastion-beluard, which receives the name "Royal" (Fig. 3, 4, 5, 6). There is a point to assume that in the middle of the eastern part, which was under a greater threat of attack, at the same time as the construction of the Strumylova bastei in the middle of the southern part, a large bastei similar to it is being built. The defensive schemes of these two parts were similar: in the middle, there was placed a high stone bastei with three tiers of defensive galleries, on the wings, there were placed lower round basteis with 1 or 2 defensive tiers.

According to architectural and typological features, the form of the Powder bastei is more suitable for the architectural forms that prevailed at the beginning of the XVI century [11], not in the second half of it. In Latin, this type of new fortification was called "Propugnaculum" and it meant a bastei or barbican [15: 105]. With this fact we want to connect another key argument in favour of the date of early construction of our bastei: in the chronicle of J. Zimorowicz in 1535 the existence of a "Propugnaculum praegrande" in the city is mentioned, in which gunpowder was stored [19: 105]. According to W. Tomkewicz, this mention concerns the Powder Tower, since only it could be described as a fortification (Propugnaculum) with the addition of "praegrande" (great)

[15: 105]. I think, we should agree with the identification of Tomkiewicz, although sometimes historians associate this mention with the City Arsenal [15: 105]. The Arsenal building in Lviv was not a fortification, so it is debatable to call it propugnaculum.

From the historical plans of the city, it is known that the Strumylova tower was always empty, it never had an overlap of the internal space or roof. The name "Propugnaculum praegrande" could only be applied to one of these two objects – either Strumylova or Powder Tower. Therefore, we should agree with the binding of this name to our object, since it was impossible to store gunpowder in the open space of Strumylova bastei. It was from this time that part of the inner space of our bastei was blocked for storing gunpowder, and it was from this time that the name "Powder Tower" was assigned to it.

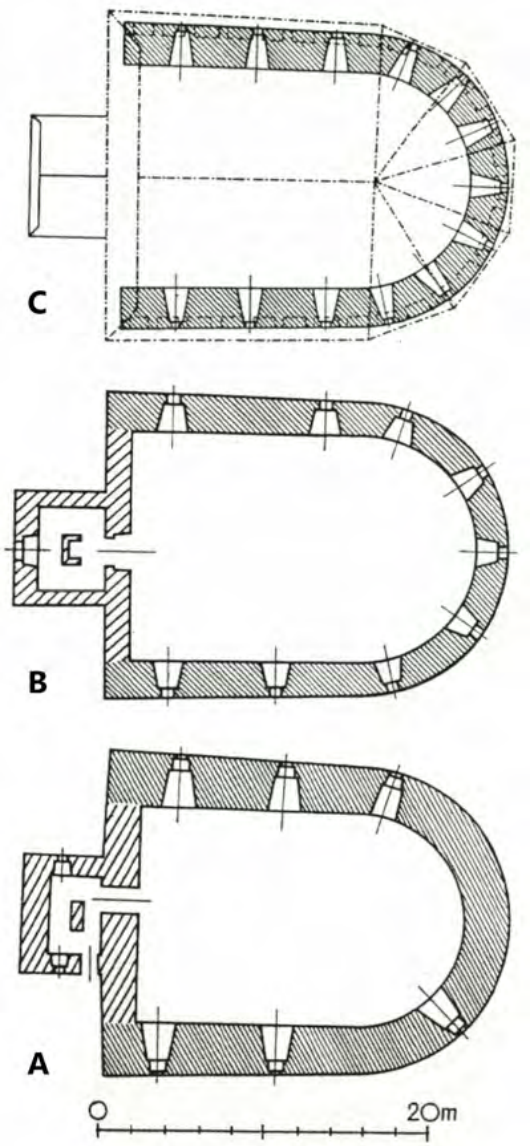

Fig. 8. Reconstruction plans of three historical tiers of the Powder Tower by J. Witwicki, A – the plan of the first tier with 6 loopholes; B – the plan of the second tier with 9 loopholes; C – the plan of the third tier with 13 loopholes [18: 164]

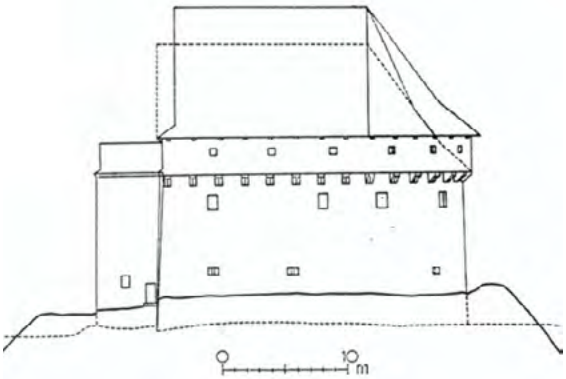

Fig. 9. Reconstruction drawing of the southern facade of the Powder Tower by J. Witwicki [18: 165]

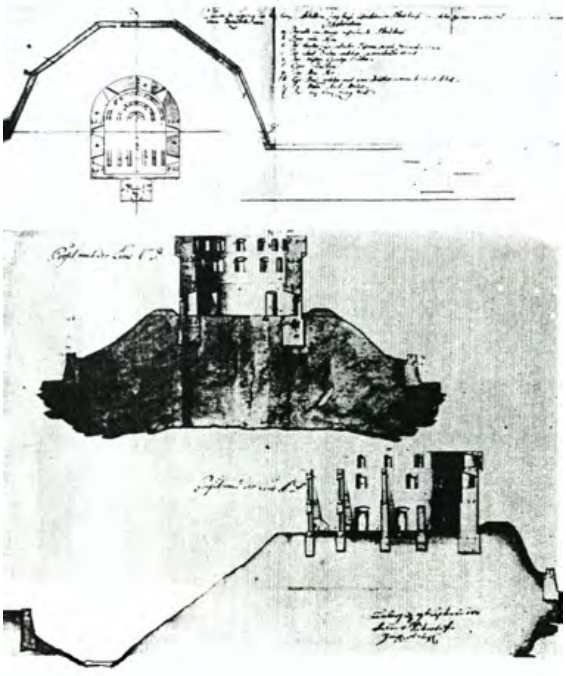

Fig. 10. Drawings of the plan and transverse and longitudinal sections of the Powder Tower building since 1784 (the Lviv city archive [18: 165])

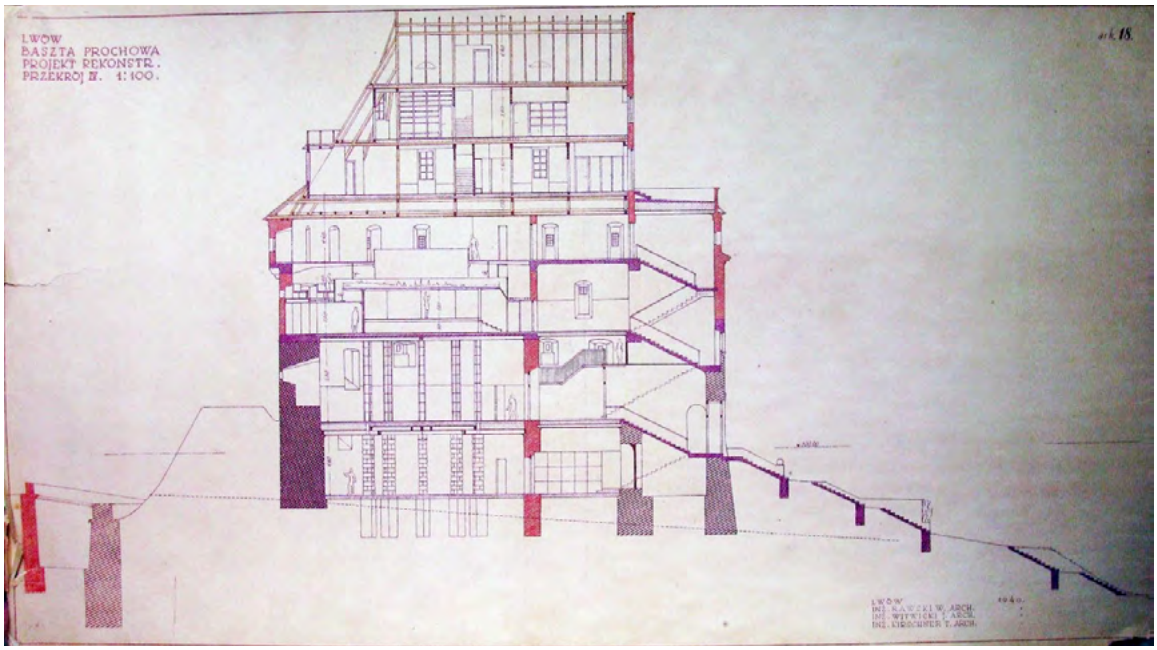

Fig. 11. Project of restoration of the Powder Tower and its adaptation for the exposition of the model of mediaval Lviv; 1940, architects W. Rawski, J. Witwicki [13]

Another argument in favour of completing the construction of the Powder Tower in the 1530s is the history of the construction of the south-western bastei Vuzheva. From the documents it is known for sure that it was finished in 1540 and its construction was carried out to restore the city's fortifications after the fire of 1527 [15: 108]. But it already has a more modern faceted five-pointed protobastion shape – the so-called puntone (Fig. 4, 5). It was built after the fire in Lviv, between 1527–1540. That is, the basteis, which were laid after 1529, already had slightly different architectural, planning and fortification parameters than those that were laid in 1522. A similar phenomenon can be observed near the Powder Tower, when here, after the construction of Carmelite Church and the construction in the 1630s in the third defensive line of the gate, a little to the south of it, the bastion "pyatta-forma" was erected (Fig. 3). Initially, there was a small triangular bastei, which is indicated on the plan of J. Behrens (Fig. 3, 4).

Therefore, we should support W. Tomkewicz's version of the earlier date of construction of the Powder bastei in 1522–1535. Together with Strumylka, they defended the most defensively dangerous eastern and southern parts of the city's fortifications. It is important to note another defensive feature of these two objects as the most powerful in terms of defensive parameters, they are placed in the middle, not on the corners. This is an important feature, which is a confirmation of the early laying of objects, at the beginning of the XVI century. Later, the most powerful objects begin to be built in corners and cornerstones in places where defensive lines turn and break. Bastei has a horseshoe-shaped plan and had originally an open interior space with two tiers of wooden defensive galleries. The walls are made of hewn and broken limestone on a strong lime filling. Loopholes are partially preserved in the walls. The loopholes were originally located in three tiers: 6 loopholes in the first tier, 9 in the second and 13 in the third [6]. Dimensions of the building: length – 24 m, width – 19.5 m, thickness of the walls 3 m in the lower and 1.9 m in the upper part [9: 88]. The upper fourth tier of the tower has not been preserved (Fig. 11). It protruded in the form of machicolations on crockstins along the entire perimeter of the structure approximately 0.7 m beyond the outer plane of the wall (Witwicki [18]). Machicolations in the Italian style were stone, as indicated above, on profiled white stone brackets located at intervals of approximately 0.9–1 m. In 1954, the interior of the building was reconstructed, and in 1959 it was adapted to serve as a residence of the Union of Architects. This project has a character of the reconstruction of the object, not its restoration. The previous project of adaptation of the Powder Tower for the function of museum was much more perfect from the restoration point. Designed at 1940 by W. Rawski and J. Witwicki (Fig. 11).

In 1973, some restoration works were carried out: the external walls were cleared of plaster, loopholes were opened and restored, inauthentic windows were partially bricked up, and later windows were cut through [9].

The author of the third line of fortifications of the Lviv city centre, a part of which the Powder Tower is, unfortunately, has not been identified, although there is no doubt that it was professionally designed as a single fire complex for hand firearms and heavy and gross artillery. It can be assumed that the author was one of the Italian builders who dominated in the construction affairs of the city in the XVI century. It would be possible to try to identify the author by very meticulous analysis of authentic white-stone details of the tower: loopholes, consoles, corner blocks of openings, etc.

The third defensive line has been upgraded several times. Analysis of the active period of its functioning shows that it was an external element, but an integral part of three defensive belts that interacted in creating an impregnable barrier to the city centre. The last attempts to modernize it date back to the Austrian era at the end of the XVIII century (Fig. 7). A detailed reconstruction of the development stages of the eastern part of the city fortifications with the „porta Ruthenika" gate is still waiting for its researcher, despite most of the work already done by his predecessors (W. Tomkewicz, J. Witwicki, V. Vuytsyk, O. Czerner, J. Lobocki, M. Bevz, I. Okonchenko, Y. Dubyk, U. Pikhurko, etc.) [1, 4, 15, 18, 19]. No less interesting is the history of the site of the eastern part of fortifications after their dismantling at the beginning of the XIX century. In 1821, a well-maintained system of squares with a promenade was created here (a project commissioned by the official Raitsenheim), and the first Austrian gymnasium was built (Fig. 12). With the construction of the governorate building, the squares were modernized into a park and it is called the Governor's ramparts [4].

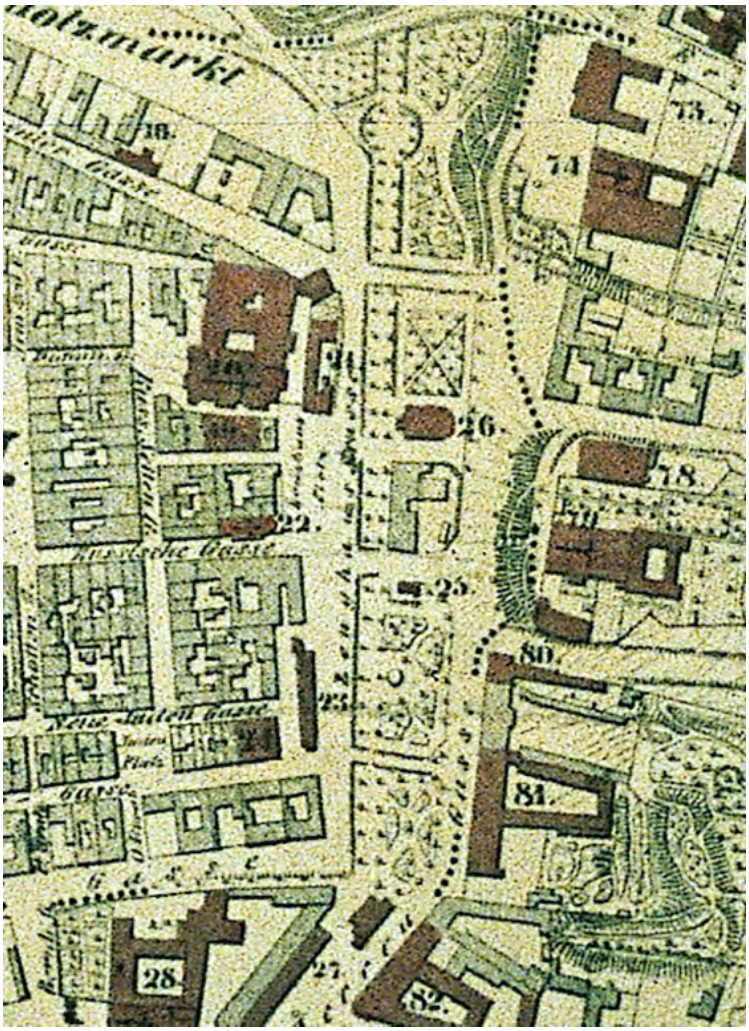

Fig. 12. Powder Tower in the planning structure of the park and promenade authored by Raitsenheim in 1844 (the plan of the city of Lviv in 1844, Military Archive of Austria [8], photocopy by M. Bevz). The round park square is marked in the northern wing of the «Governor's ramparts" promenade. This round square appeared in our opinion because the dismantling of the remains of the royal bastion revealed the 16th century oundations of the round bastei-tower.

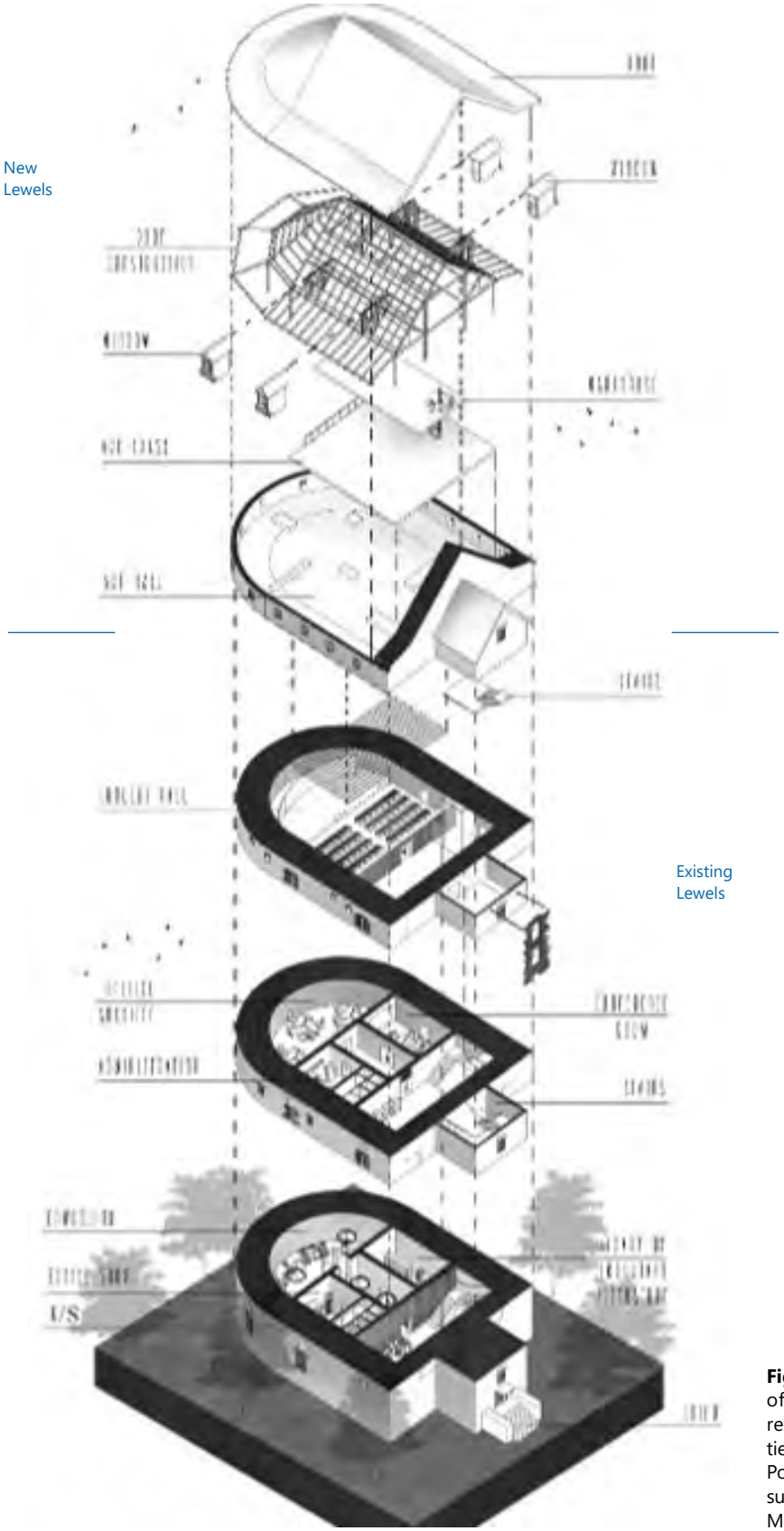

Fig. 13. The restoration concept of the Powder Tower with the reproduction of the lost fourth tier (2019; diploma project, Lublin Polytechnic: Dmytro Plesnytskyi; supervisors: prof. B. Szmygin, prof. M. Bevz)

In 1890, the magistrate proposed a Powder Tower, which stood in ruins, with the surrounding area as a place for the construction of a Ukrainian theatre. This proposal was not accepted [9], but since that year a summer theatre has been built on the site of the grand beluard. Subsequently, it was planned to rebuild the Powder Tower into a city archive and a museum with a lapidary (projects of architects M. Lużecki and K. Mokłowski, 1896) [14]. It was also planned to erect a monument of T. Shevchenko, at the end of the XIX century. At different times, projects were born to dismantle the tower and build other buildings here. In the 1880s, the tower was saved from disassembly only thanks to the protests and perseverance of the conservative W. Łoziński.

In Soviet times, a highway with an entrance to the tunnel was supposed to be here to allow traffic flows under the High Castle. Fortunately, these projects were not implemented. Recent projects include the idea of building a cable car lift station to the High Castle in the northern part of the ramparts (on the site of the former Royal bastion). If this proposal was combined with the restoration of fragments of the third defensive line and the Royal bastion and did not have a traction node, it could be considered. The function of the Powder Tower building as the centre of the National Union of Architects of Ukraine is very suitable for the object. The tower building, which was specially reconstructed and adapted to this function, already has its own "union" history [14]. There is no doubt that this feature should have remained in this unique monument. Still, the object needs restoration. It would be necessary to better adapt the building to modern needs and perform a restoration reconstruction of the lost fourth tier with a machicolation belt (Fig. 8, 9, 10, 13).

Conclusions

As a conclusion we want to express the following:

The Powder Tower is unique in architecture life-size fortification object of medieval Lviv that has been preserved. It is a representative of the defensive architecture of the XVI century, an element of the third (out of five) belts of fortifications of the Lviv city centre. The architectural value of the object is not limited to Lviv. There are very few preserved relics of urban fortifications in Ukraine. Their presence is extremely rare. The Powder Tower represents a specific type of military architecture, analogues of which can be found in Ukraine only in Kamianets-Podilskyi. The Powder Tower, as a unique memorial defensive structure, should become the object of professional restoration work.

If we agree with the date of the beginning of the construction of the Powder Tower in 1522, then soon the architects will celebrate the 500th anniversary of the construction of the only preserved monument of fortification architecture in Lviv. A worthy celebration of this date would be a professional restoration of the monument with the reproduction of the lost machicolation tier.

The environment around the Powder Tower, in addition to the extraordinary value of architectural space, has preserved archaeological remains of a unique complex of fortifications of the XIV-XVI centuries. Improvement and architectural and landscape transformations of the territory around the Powder Tower should be considered in the complex of regeneration of the eastern part of the fortifications of the city centre of Lviv, as an architectural and archaeological complex of three defensive lines. The task of improving the territory of the former Governor's ramparts cannot be realized without museumification of unique defensive structures and the development of underground space full of archaeological sites. An important element of activity for professional transformation and revitalization of the environment is to conduct extensive archaeological and architectural research throughout the former ramparts.

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Building engineering issues in Architectural education in Poland, in context of actual Ministry of Science and Higher Education Regulations

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Abstract: The article presents the curriculum for architectural studies in the context of technical courses, such as building engineering, structures, materials science and building physics. The authors of the publication compare the method of conducting these courses and their participation in the entire study program on the example of selected Polish universities (Faculty of Architecture of the Wrocław University of Science and Technology, Faculty of Architecture and Building Engineering of the Lublin University of Technology and the Faculty of Technical Sciences, University of Applied Sciences in Nysa). Authors of the article present changes that have occurred in the curriculum of these courses before and after the reform of higher education from 2019, what impact it has on the education of future architects, and what new opportunities these changes offer will be analyzed.

Keywords: engineer education, architectural education, engineering courses, general construction, education reform

Introduction

Architectural education is a subject of discussion in both professional and scientific circles. Its criticism mainly concerns putting too much emphasis on the formal, spatial, visual and theoretical aspects of architectural design and separating them from technical subjects, which are often taught in an unattractive, simplified and non-visual way [14], [13], [3]. Currently, the changing realities of the architect profession in accordance with economic and climatic conditions, the increasing share of the importance of social competences and "business" skills, and most of all the introduction of BIM tools, mean that educating architects today should differ significantly from that of several years ago [6], [11]. So far, teaching construction and engineering at Polish universities could be conducted autonomously, without relation to design subjects, but due to the new teaching standards the situation has changed. The current Ministry Regulations [12] and trends modelled on Western European and global solutions are aimed at raising architectural education to a higher level, adjusting education from the first years of studies to the realities of the profession where multi-industry is a key issue. For this purpose, the problems discussed in design subjects overlap and complement construction and engineering subjects. Students learn about general construction issues not only in theory but also in relation to their own projects, which shows the inextricable relationship between engineering and architecture.

Current reform of higher education in the country [12] has brought significant changes of the program for architectural studies:

- an increase (to nearly 50%) in the share of design classes in the total number of hours;
- a compulsory one-semester design work placement carried out during the course of study;
- the curriculum standard for the Long-cycle Master's degree program;
- detailed definition of learning outcomes by groups of activities;
- increasing the number of semesters (in first cycle studies from 7 to 8) and the minimum number of hours in the program (in first cycle studies from 2500 to 2800, in second cycle studies from 900 to 1000) [7] [8].

Polish Chamber of Architects draws attention to the need for each autonomous university to adapt the new standards individually, according to its needs, position, location in the region and the mission it fulfils in the system of scientific, professional and social education [9].

Research Method

The article uses a comparative research method. The engineering group of course curriculums in architectural education, for first cycle studies, on the example of three universities in Poland, has been analyzed and compared before and after the reform [12]. A particular emphasis has been put on the syllabus changes of General Construction course (or Building Engineering course – the name of the course is used interchangeably at universities), as the basic and leading subject of the engineering group of courses. The curricular changes will be presented in tabular form, for each of the presented university. It aims to demonstrate the autonomous approach of universities to implementing curricular changes and to seek the best standards for implementing these changes.

Three public universities were selected for research, differing in the age of their foundation, size, as well as traditions and teaching methods. At the same time, each of them is representative for its group: Wrocław University of Science and Technology belongs to the group of large universities with many years of teaching tradition in the field of architecture, Lublin University of Technology is an example of a public university where teaching architecture coincided with the introduction of the Bologna system, and the University of Applied Sciences in Nysa belongs to the group of higher vocational schools, created to meet educational needs in smaller centers.

Faculty of Architecture at the Wrocław University of Science and Technology

Wrocław University of Science and Technology is one of the largest technical universities in the country, with thirteen Faculties and around 4000 graduates each year. Since 1945, the Faculty of Architecture has functioned within the structure of the Wrocław University of Technology, initially as a division of the Faculty of Construction, and since 1949 as an independent Faculty. Since 1950, the Faculty of Architecture has received full academic rights to confer the degree of Doctor in technical sciences, and since 1960, continuously, the right to confer the degree of Doctor with Habilitation Degree.

Share of engineering courses (hour schedule) in the curriculum at the Faculty of Architecture of the Wrocław University of Science and Technology [Table 1].

Table 1. Hours schedule of technical courses at first cycle studies (engineering), before and after the education reform according to the Regulation of the Ministry of Science and Higher Education of 18.07.2019 [16][17] at Faculty of Architecture of the Wrocław University of Science and Technology. Forms of courses: L – lecture, E – exercise, D – design, S – seminar.

Course / group of courses	**Standard of education PRE – REFORM (hours)**				**Standard of education POST-REFORM (hours)**				**General remarks**
Form of course –>	**L**	**E**	**D**	**S**	**L**	**E**	**D**	**S**	
Building Materials Science	15	15			**15**	**15**			Number of hours and syllabus content unchanged.
Mechanics of Structure	45	45			**30** *(–15)*	***30*** *(–15)*			Reduction in the number of lecture and tutorial hours.
General Construction	45	60	75		**15** *(–30)*	**75** ***(+15)***	0 *(–105)*		Significant reduction in hours, lack of individual construction designs (changes will be detailed in the next chapter).
Civil Structures	30	120			**0** *(–30)*	**60** *(–60)*			Significant reduction in tutorial hours. No lectures.
Building Physics	15	15			**15**	**15**			Number of hours and syllabus content unchanged.
Building installations and urban technical infrastructure	30			15	**30**			**0** *(–15)*	Lack of seminar classes, allowing to learn in detail the problems of designing building installations.
Total hours:	180	255	75	15	**105** *(–75)*	**195** (–50)	**0** *(–75)*	**0** *(–15)*	

The number of hours from the technical course group has been reduced, but some subjects e.g. General Construction will be introduced into the Architectural Design courses. However, it is currently difficult to predict what their share will be in real terms, on an hourly basis. In addition, in the second cycle, the number of hours of the Structural Engineering course is supplemented by the *Structures in Modern Architecture* course (lecture 30 h, tutorials 60 h, total for 1 and 2 semesters of the second cycle program).

General Construction course reform changes for Faculty of Architecture of the Wrocław University of Science and Technology

A post-reform fundamental change in the general construction course is its reduction from a four-semester cycle to a three-semester cycle. In the first semester, the program is implemented without any changes, the aim of which is acquisition of elementary knowledge of technical drawing, basic elements and structures of buildings, acquisition of skills in recognizing and interpreting basic elements and structures of buildings, learning and acquisition of the skills to apply the basic regulations in force in the construction industry. The course

is conducted in the form of drawing tutorials. The second semester of general construction before the reform took the form of a design task on which the students had designed a staircase in a detached house on a scale of 1:50, including detail drawings. Students applied the knowledge acquired in the previous semester in practice. A post-reform course develops and supplement the knowledge of technical drawing, basic elements and systems of buildings, skills in recognizing and interpreting basic elements and systems of buildings, – learning and acquisition of the skills to apply the basic regulations in force in the construction industry. The course is conducted in the form of drawing tutorials. The third semester before the reform was carried out in the form of exercises aimed at broadening the acquired skills. Students were able to search for, analyze and select information from a variety of sources on the use of appropriate materials, structures and building technologies in the design of a selected building system, use their skills in technical and construction drawings in practice. Students in the tutorials had developed a detailed design of a complex building form – a roof truss over a single-family house. After the reform, there will be no continuation of the General Construction course in its original form in the third semester. In the fourth semester, this course, before the reform, was the culmination of basic knowledge in the field of building construction and assumed the implementation of a technical project of a single-family house. It was conducted as design course. After the reform this course is conducted under the name Modern Building Solutions and it aim is to acquaintance with modern construction solutions, modern materials used in construction, development of skills of designing architectural and construction details Classes are conducted in the form of multimedia presentations developed by students, with discussion moderated by the lecturer.

Within the post – reform General Construction course block a reduction in class hours is significant. Classes will not have individual design development as part of their syllabus content (in the previous teaching standard, the courses included two technical and construction designs). Due to increase of numbers of hours in design studio block, some engineering and technical issues will be developed in paralel to general design course, in so called Integrated Design Studio, which is to offset the reductions in hours in the engineering course block.

Architecture at the Faculty of Construction and Architecture of the Lublin University of Technology (FCA, LUT)

The Lublin University of Technology was founded on the initiative of the local community of technicians and engineers in May 1953 as the Evening School of Engineering. The Faculty of Civil Engineering was established in 1965, in the same year the university was transformed into the Higher School of Engineering, and in 1977 into the Lublin University of Technology. In 1986, the name of the Faculty of Civil Engineering was changed to the Faculty of Civil and Sanitary Engineering, and within this faculty, architectural studies were launched in 2004.

Share of engineering courses (hour schedule) in the curriculum at the Faculty of Construction and Architecture of the Lublin University of Technology [Table 2].

Table 2. Hours schedule of technical courses at first cycle studies (engineering), before and after the education reform according to the Regulation of the Ministry of Science and Higher Education of 18.07.2019, [2], [4], at Faculty of Construction and Architecture of the Lublin University of Technology. Forms of courses: L – lecture, E – exercise, D – design, S – seminar.

Course / group of courses	Standard of education PRE-REFORM (hours)				Standard of education POST-REFORM (hours)				General remarks
Form of course –>	L	E	D	S	L	E	D	S	
General Construction	60		30		60		45 *(+15)*		Increase in the number of hours (changes will be detailed in the next chapter)
Mechanics of Structure	30	30	30		30	30	30		Transfer of the subject from semester 1 to semester 4 in order to coordinate the content with issues of building structures.

Materials Science	30			15	30			15	The scope of materials testing in the laboratory has been expanded.
Structural Engineering	90	30	30		30 *(−60)*	0 *(−30)*	30		Reduction in hours. Significant reduction in scope.
Building Physics	30	15		15	15 *(−15)*	0 *(−15)*	15 *(+15)*	15	Introduction of design classes, extension of the syllabus contents with acoustic issues.
LIS and ordinance survey maps	15			30	15		15		Changes in the name of the course, before the reform: Land surveying (5th sem.). Change of the form and scope of classes after the reform (3rd sem.)
Roads and Streets	30				15		15		Change in the form of classes (design added)
Construction Technology and Organisation	30		15	15	15		15		Before 2nd sem. (5, 6) subject: Technology and Organisation of Investment Process In sem. 6 Economics of Investment Process: 15 L, 15 D – subject eliminated
Building Installations and Urban Municipal Infrastructure	30		30		15 *(−15)*		30		Reduction in lecture hours – 15, ECTS credits by 1 and moving the course from sem. 4 to sem. 5
Total hours:	345	75	135	75	225 (−20)	30 (−45)	45 (−90)	180 (+105)	A total reduction of 150 hours in this subject group.

As a result of the reform, the number of hours from the engineering course group has been reduced by 150. There have been changes in the content of the syllabuses dictated by the need to adapt to the new standards and the shifting of subjects in the course of study. Major changes in syllabus content and hours allocated to the subject have affected Structural Engineering. Before the reform, the subject was implemented in 4 semesters, after the reform, structural engineering, in its basic scope, is implemented in sem. 5 and 6. Thus, the program content of the first cycle has been limited, in accordance with the scope required for the scope of architectural designs undertaken as part of the engineering studies, while at the second cycle the structural issues have been broadened to correlate with the difficulty of the subject matter undertaken during the master's studies.

General Construction course reform changes for Faculty of Construction and Architecture of the Lublin University of Technology (LUT)

At Lublin University of Technology, the main aim of General Construction course concerns learning about the classification and design principles of buildings, building systems and components as well as the basic regulations applicable to the construction industry [8, 9, 16], is continued, but the course shows changes, resulting from discussion between the teachers of engineering subjects and architectural design. It was agreed that a better understanding of construction issues would be achieved with freehand drawing as a tool in the initial stage of learning. The syllabus for design form of classes in the first semester, contents making drawings as well as architectural and construction details in traditional technology, in permanent technique. So far, students have the freedom to use the tools, which often resulted in a lack of understanding drawn structure.

In the second semester of study, the aim of the „General Construction" is to develop architectural and structural assumptions for the design of a residential and multi-family building in traditional improved technology. Students are being taught how to draw plans of: foundations, ground floor, typical storey, roof trusses, roof and vertical sections, as well as how to prepare calculations of heat transfer coefficient of walls. Development of a technical description of the building is studied on individual examples of projects developed in design studio. It should be noted that the General Construction course is the only one in the group of engineering subjects taught in Architecture at the LUT to show a slight increase in hours after the reform.

As a result of the introduced reform, summer practices on the construction site (so far after the second year of first cycle studies) have been shifted to the second-cycle studies – master's, so graduates of engineering studies do not get to know the construction site. In order to compensate for this shift in the curriculum resulting from the new teaching standards, didactic tours covering construction sites have been introduced as a form of teaching in many classes, so that the link between design and implementation is also visible in the first cycle studies. With an overall reduction in the total number of teaching hours in engineering subjects, the introduction of on-site practice as part of the course of study is an indispensable element of education.

Architecture at the Faculty of Technical Sciences of the University of Applied Sciences in Nysa (UAS)

The University of Applied Sciences in Nysa is a state vocational school founded in 2001 and in accordance with its Mission Statement it is part of the academic tradition of Nysa, oriented towards cooperation with the region and stimulates its development. The university plays an important role in the local environment and also fulfills an important cultural role, both in terms of popularizing science and the arts. The major of *Architecture* has been taught at the University since its establishment; currently, students have the opportunity to study at the first cycle level and also choose from 2 specialization: *Light Architecture* (LA) and *Conservation and Protection of Monuments* (CPM). The technical and construction subjects have been the basis of teaching since the beginning of the architecture major, irrespective of the specialization chosen.

Share of technical courses in the curriculum at the Architecture of the Faculty of Technical Sciences of the UAS in Nysa [Table 3].

Table 3. Hours schedule of technical courses in first cycle studies (engineering), before and after the education reform according to the Regulation of the Ministry of Science and Higher Education of 18.07.2019 [5], [1] at the Architecture of the Faculty of Technical Sciences of the UAS in Nysa. Forms of courses: L – lecture, E – exercise, D – design, La – lab.

Course / group of courses	**Standard of education PRE-REORM (hours)**				**Standard of education POST-REFORM (hours)**				**Remarks**
Form of course –>	**L**	**E**	**D**	**La**	**L**	**E**	**D**	**La**	
Building Materials Science	45			15	**30** *(–15)*			**15**	Slight reduction in the number of lecture hours. No changes in the scope of core syllabus content, discussed at a higher level of generalisation.
Mechanics of Structure	30	30			**30**	**30**			Number of hours and syllabus content unchanged.
Construction general education	60		60		**45** *(–15)*		**30** *(–30)*		Significant reduction of hours, especially limiting the scope of semester design development, which includes construction and execution documentation of a single-family residential building (changes will be detailed in the next chapter).

Structural Engineering	90		75		**45** *(−45)*		**45** *(−30)*		Significant reduction in hours. No changes in the scope of core syllabus content of lectures, discussed at a higher level of generalisation. Inability to relate the presented content to engineering practice in detail. Significant reduction in the scope of semester design development.
Building Physics	15		15		**15**		**15**		Number of hours and syllabus content unchanged.
Building Installations	30		15		**15** *(−15)*		**0** *(−15)*		Significant reduction in the number of lecture hours. Limited scope of core syllabus content, discussed at a higher level of generalisation. No design classes.
Urban Technical Infrastructure	30				**15** *(−15)*				Significant reduction in the number of lecture hours. Limited scope of core syllabus content, discussed at a higher level of generalisation.
Total hours:	300	30	165	15	**195** *(−105)*	**30**	**90** *(−75)*	**15**	

Curricular changes, resulting from the limits set by the educational standard, introduced in the group of subjects B.2: *Design Context: Engineering, Technique and Technology*, a significant reduction in contact hours in lectures (−105 hours) and design classes (−75 hours). The changes in the curriculum introduced at the University of Applied Sciences in Nysa were aimed at meeting the current formal requirements, while preserving the developed didactic methods, based on the presentation of theoretical content, supplemented with examples referring to everyday engineering practice. Some of the syllabus content implemented as part of the semester designs in the General Construction courses, was planned to be completed as part of the so-called Integrated Design. These classes, referred to as "*design B*" in the syllabuses, are implemented as general construction consultations for architectural and urban design (e.g. in the courses Single-Family Housing and Multi-Family Housing).

General Construction course reform changes for Faculty of Technical Sciences of the UAS in Nysa

The General Construction course will continue to be delivered in the form of a two-semester, but in a reduced number of hours. The first part of the course, implemented in the second semester of the engineering studies cycle, will slightly change after the reform. The aim of the course, without changes, is acquiring elementary knowledge related to technical requirements, technology selection, design and construction of simple residential buildings with traditional technology as regards foundations, walls, intermediate floors and chimneys. The number of hours for the design part is reduced from 30 h to 15 h after the reform. Course still take the form of a lecture and design classes. The second part of the course has been significantly reduced compared to the situation before the reform. Lectures and design classes were cut by half (from 60 hours before the reform to 30 hours after the reform). The program is implemented in a similar way. Aim of the course is acquiring elementary knowledge related to technical requirements, technology selection, design and execution of balconies and terraces, stairs, roofs and roof slabs and finishing works. Design classes aim to preparation of building cross-sections, roof plane plan, roof truss plan and cross-sections, and staircase drawings. However, after the

reform, due to time constraints part of the syllabus content related to the development of building sections, roof plane plan and construction-architectural details is implemented as part of the multi-industry consultation for the course "Single-Family Housing" from the Architectural Design subject group.

Conclusions

The introduction of the new educational reform enables a transparent comparison of the methods of its implementation at different universities. The university's autonomy makes it possible to implement these changes in a way that best suits its needs and standards. At the Lublin University of Technology it has been decided not to combine the syllabus content of the engineering subjects with architectural design in a direct way, in favor of independent implementation of design tutorials, laboratories or tutorials. At the same time, the instructors of architectural and engineering subjects, during a series of meetings that accompanied the creation of new curricula, directly submitted their comments and expectations, which was a very important element in the development of syllabuses. At the Wrocław University of Science and Technology and the State Vocational School in Nysa, it was decided to integrate design classes and general construction courses. Such classes are to be implemented along the lines of Western European standards in architecture schools, where the so-called Integrated Design Studio includes multi-discipline architectural designs. However, not all universities have clarified, at the stage of preparing the new teaching standards, the hourly share in this form of classes to be allocated to general construction. This form of leading design courses is new for presented universities, and provides a comprehensive and multi-dimensional approach to an architectural design.

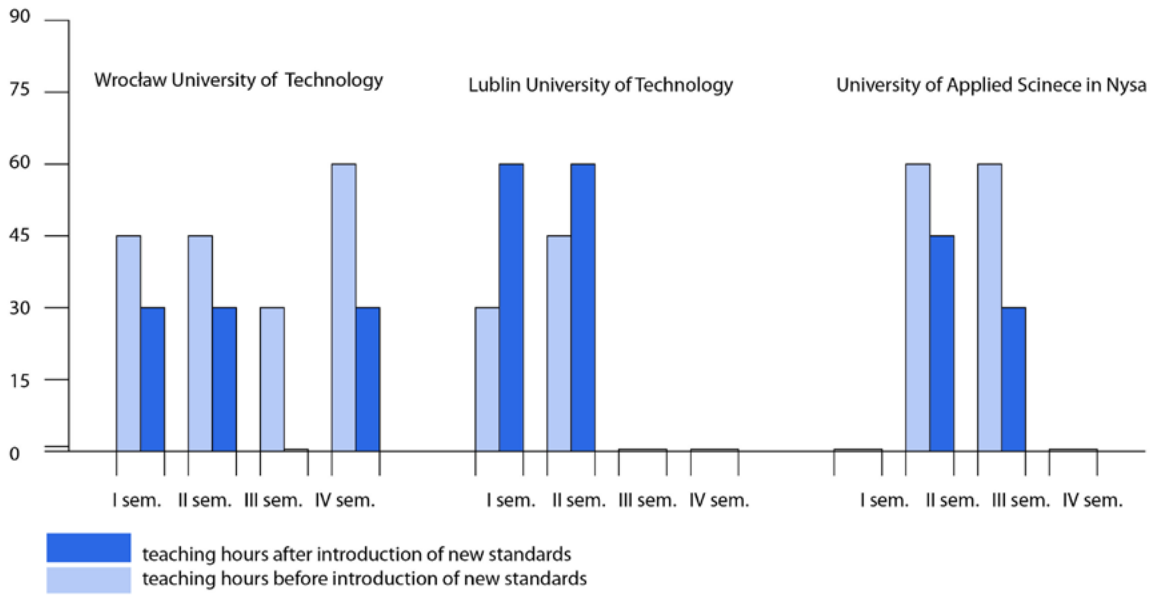

Fig. 14. General Construction course – comparison of the number of hours in a semester for the analyzed universities

We observe a significant reduction in the number of hours of engineering courses in all analyzed course curriculums, without major changing the syllabus content for the subject. Consequently it affects the impossibility of implementing the program without harming the overall training of engineering competences. The implementation of all topics in a limited time, requires the use of limited forms of presentation of the basic content, without the possibility of in-depth analysis and full reference to examples from everyday design and executive activities. The complexity of the process of education of technical courses, requiring a multidimensional approach – combining practical classes in the form of laboratory tasks or visits to the construction site, and theory, presented in the form of lectures and exercises, is shown by research on the education process of technical courses at the Faculty of Architecture by Bogdan Siedlecki [15]. Also experimental methods of teaching

a material science course based on practical and design classes developed and described by Paweł Mika [10] shows the important relation between the amount of time and commitment devoted to a given activity and the subsequent learning outcomes. Another conclusion is the need to transfer a certain range of tasks, so far carried out within the framework of classes, to the individual work of students in order to complete the full curriculum. Consequently, students will follow the program unequally, and knowledge enforcement may be problematic.

General Construction course reform changes (hours reduction) for analyzed universities are presented in Fig. 14, presenting the hourly schedule of classes in the following semesters before and after introducing the new standards due to Ministry Regulations.

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