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Research Article

Informative integration of modern spolia in public landscapes

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ABSTRACT

Spolia refers to repurposing components from older buildings into new constructions, a concept with a rich history. Traditionally, unique components were the primary focus; however, this approach remains relevant today for mass-produced components. By diverting materials from waste streams, spolia preserves their inherent properties and facilitates the rapid transfer of stylistic features in the modern world. When a 1970s movie theatre in Moscow, Russia, was demolished in 2019, a substantial amount of steel was recycled, while brick and concrete were sent to landfills. This study investigates potential spolia options as an alternative to demolition. The research involved documenting the building's urban and architectural context through a literature review and on-site visual documentation conducted during the demolition. This process also aimed to uncover the history related to the production and characteristics of the materials used in the building. The study focused on estimating the building's material stock and identifying the approximate quantity of reusable items to strengthen the rationale for potential spolia execution. The research emphasizes developing a design alternative that utilizes the identified materials within a public landscape. This approach includes adding data labels to inform the community about the source of the materials. The significance of this study lies in providing a valuable record of this lost building. It also offers a proposal that contributes to the community's memory through the materials of a demolished neighborhood structure while highlighting the importance of recovering materials from waste streams.

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1. INTRODUCTION

The world faces a growing challenge with the increasing waste generated by various industries, and the construction sector is no exception. Significant contributors to this waste include the production of building materials, construction processes, maintenance throughout a building's lifespan, and demolition at the end of its life cycle. Among these, demolition waste is particularly concerning, driven by the rising number of demolitions associated with ongoing urbanization and transformations [1]. When demolition is unavoidable, gentle deconstruction can offer a sustainable alternative, enabling the recovery and reuse of materials [2].

The practice of salvaging materials from older structures, known as spolia, has a long architectural history. Spolia involves integrating components from older buildings into new constructions. Historically, this practice was motivated by practicality, as it provided ready-made materials from ruins without requiring new production [3]. These reused elements often retained their original characteristics, showcasing the material and craftsmanship of their time. The nature of these components varied greatly, ranging from intricately handcrafted pieces adorned with inscriptions to vernacular techniques and ordinary objects [4].

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In modern contexts, salvaging materials during the deconstruction of contemporary buildings represents a new form of spolia. The components in such cases are predominantly mass-produced and industrially fabricated. Despite this shift, their reuse remains significant, reflecting the rapid evolution of production technologies and changing stylistic preferences over time [4].

This study explores the potential data lost during the 2019 demolition of the Vityaz Movie Theatre, a 1970s structure in Moscow, Russia. The investigation assesses the building's history, material, and craftsmanship qualities to generate an applicable spolia scenario. The demolition revealed substantial quantities of brick, steel, and concrete, notable for their appearance and workmanship, which were ultimately discarded through landfilling or downcycling. A comprehensive review of spolia produced worldwide was conducted to provide a foundation for this research, as detailed in the literature review section.

The Materials and Methods section outlines the data collected on the materials of the Vityaz Movie Theatre, including their historical significance within the urban and architectural contexts. It details the production and use of these materials during their active periods and describes the methodology employed to estimate the total quantities embedded in the building. Additionally, this section proposes repurposing these materials in a sample public landscape project as a tribute to the era.

The Results section presents the findings in tabular format, highlighting significant material quantities. It also includes a representative 3D drawing of the proposed reuse scenario, accompanied by informative labels to inform the community about the history of the materials.

In the Discussion section, the findings are framed and compared with the findings of the reviewed literature.

Finally, the Conclusion section underscores the importance of the study and its contribution to the existing body of knowledge, emphasizing its relevance for future research and practice.

2. LITERATURE SURVEY

The longevity of buildings plays a vital role in preserving and transmitting heritage across generations. Structures are physical links to the past and reflections of evolving rural and urban landscapes. The environment constantly transforms as architectural styles, societal needs, and construction technologies advance. In this dynamic context, preserving and documenting buildings, materials, and craftsmanship becomes increasingly important for safeguarding cultural and historical continuity.

The International Council on Monuments and Sites outlines key preservation principles aimed at safeguarding the values of heritage buildings. These principles emphasize minimal intervention, ensuring that any changes to the structure are kept to the necessary minimum to avoid altering its original character [5]. They also promote reversible repairs so that future restorations can undo changes without damaging the building, and they recommend that any new additions or modifications be identifiable and distinguishable from the original work.

A systematic and scientific approach to documentation and recording throughout the preservation process is essential to ensure that all interventions are tracked for future reference. Preservation strategies are categorized into four key processes: conservation, restoration, renovation, and replacement, depending on the degree of intervention required [5]. These principles provide a solid foundation for preserving cultural heritage buildings, allowing them to retain their structural integrity and historical authenticity while continuing to serve future generations.

Conversely, buildings not classified as heritage assets are more prone to neglect, deterioration, and eventual demolition. This vulnerability is especially evident in areas undergoing rapid urban transformation, where entire structures and their valuable material properties are lost almost instantaneously. This loss often stems from underestimating or overlooking potential opportunities at various scales beyond the building's overall fabric [6]. Revisiting the concept and definition of spolia offers a significant opportunity to explore the valuable parameters embedded in such buildings, alongside the potential for substantial waste recovery, particularly when demolition looms as their end-of-life outcome [7].

Although spolia is not inherently a preservation strategy and is primarily motivated by economic and utilitarian concerns, it is closely linked to the definition of heritage at the material scale [3]. Historically, spolia was associated with post-war discoveries and was a widespread practice during the late antique period in Rome [3]. Architectural elements from this era were repurposed into medieval churches and other structures by subsequent generations [8, 9]. This practice transcended specific historical periods, applying significantly in various eras, including Renaissance architecture [10]. Spolia were often unique and readily identifiable, as they retained stylistic elements from their original contexts. For instance, façades featuring significant figures from one culture integrated into structures of another period illustrate this phenomenon. A notable example is the Small Metropolis in Athens, Greece, where pagan, ancient, and Roman reliefs were incorporated into a Byzantine church, resulting in a richly layered composition (Fig. 1a) [11]. This approach creates a rich architectural combination and transfers partial contextual information to a new production.

In other contexts, spolia has served as a means of transferring vernacular materials and craftsmanship that evolved. In this respect, it represents a tradition born from experimental trials influenced by the dynamics of specific territories [4]. A contemporary example is the History Museum in Ningbo, China, where materials and techniques from abandoned and ruined villages were rearranged into a public-scale building. The project employed a local version of masonry construction, the Wapan technique, which combines various unit-based materials into a compelling composition [12]. The result is a rich textural aesthetic and strong reminders of the original context, expressed through material and technique (Fig. 1b).

Figure 1. **(a)** Reliefs, such as spolia, were held within the Byzantine church of the Small Metropolis in Athens, Greece [19]. **(b)** Reused materials within the History Museum in Ningbo, China [20]. **(c)** Salvaged walls within the Cubo House in Melbourne, Australia [21].

Spolia also plays a role in mundane buildings constructed during the industrial era. It communicates the past to the present, bridging historical narratives through materiality, even when the materials are mass-produced items [13]. Older components can convey meaningful documentation to contemporary audiences, especially when they exhibit significant levels of decay compared to newly produced elements [13]. This allows architects to leverage their unique characteristics to enrich artistic creations. Incorporating text-based labels on spolia items can also be a helpful approach. It is akin to museum objects that have lost their original context but retain the strong potential to convey information to an audience [14]. This value highlights the documentary significance that spolia can hold [14–16].

Even when materials are mass-produced, their integration into a design reflects the intentions of their creators and embodies values worth transferring [4]. For example, Cubo House in Melbourne, Australia, documents the narrative of a characteristic house through its integration into a new structure using salvaged materials. A carefully managed deconstruction process was implemented, allowing the materials to be reintegrated into the new building. The architects documented the history of the original structure by salvaging its components, connecting this effort to the concept they referred to as "embodied memory" (Fig. 1c) [17].

Preferring deconstruction over demolition, even for ordinary buildings slated for removal, presents a valuable opportunity to uncover overlooked spolia potential. As a material-scale strategy for transferring information, deconstruction ensures that the embedded knowledge within a building's materials is documented. Simultaneously, it acts as a significant reminder and memory book of a lost structure that may have held importance for its community, neighborhood, or even an era in a country's history by retaining the materials and craftsmanship it represents [18].

Furthermore, deconstruction contributes to social and economic sustainability by creating green job opportunities within communities. It employs identifying, recovering, and reusing materials in new construction projects, fostering community engagement [18]. By valuing and transferring materials rather than discarding them, deconstruction mitigates environmental impacts while sustaining cultural and historical continuity in the built environment, bridging the gap between past and future on a material scale.

To gain a comprehensive understanding of the demolition of the Vityaz Movie Theatre in Moscow—the primary focus of this study for potential spolia determination—an analysis was conducted on its three key building materials: brick, precast concrete, and steel. A literature review examined discussions on the spolia potential of these materials, highlighting the significance of their transfer and emphasizing the documentary value of these mass-produced items.

Ergun and Gorgolewski investigated the increasing demolition of old brick dwellings in Toronto, Canada, where a significant portion of the materials are in landfills [22]. The initial phase of their study focused on identifying and categorizing primary building types chronologically while assessing their potential for material reuse. The analysis revealed variations in the characteristics of brick walls across different construction eras, including the use of solid versus perforated bricks, wall configurations—single, double, or triple-layered—and the types of mortars employed, ranging from lime to cement or a combination of both [22].

The researchers grouped the buildings into five categories based on their construction periods: pre-1930s, 1940s–1960s, 1970s, 1980s–2000s, and post-2000s. Each category exhibited unique properties and architectural values, reflecting the evolution of building practices and styles over time [22]. The study emphasized that deconstruction offers an opportunity to transfer the characteristic features of each era into new buildings in innovative ways [22]. This approach serves for actual historical records by integrating layers of documentation.

Similarly, Axelsson's study examined industrial spolia in three buildings in Gothenburg, Sweden, emphasizing the potential of these materials as resources [23]. Among the materials analyzed, brick wall sections emerged as particularly valuable due to their potential as transferable elements for new façades. Axelsson's approach sought to preserve the craftsmanship of brick bonding, reflecting their creation period [23].

The study highlighted those bricks, bonded in diverse ways across different eras and represented significant collective memories. By incorporating these sections into new constructions, designers can create architectural collages that honor the past while introducing contemporary elements [23]. This practice enriches modern designs and fosters a meaningful connection between older and newer contexts, celebrating the craftsmanship and stories embedded in the original materials.

Similarly, a study by Ross conducted in Georgia, USA, uncovered valuable materials during the deconstruction of an ordinary dwelling, highlighting the potential to salvage historical information [6]. The building, dating back to the 1870s, contained bricks handmade by enslaved individuals in the early nineteenth century [6]. This discovery is significant as it illuminates a crucial aspect of history and recovers a valuable narrative that would likely have been lost. By highlighting this value, the study emphasizes the importance of deconstruction to preserve the stories embedded in time.

A similar industrial spolia potential exists for precast components, which researchers worldwide have identified as playing a significant role in the global building stock [24–27]. Rapid urbanization in metropolitan areas has primarily driven this trend, where the demand for expedited housing solutions has been paramount [9]. Additionally, the post-World War II era saw a surge in the need for rapid repairs and replacements, further accelerating the adoption of precast concrete in construction [25].

Precast components, designed for off-site manufacturing and on-site assembly, offer substantial potential for disassembly and reuse in new constructions, even though they were not initially intended for this purpose [25, 26]. Their urban mining potential makes them invaluable, providing opportunities to salvage materials, promote environmental sustainability, and reduce construction waste.

While much attention has been given to their material value and ecological benefits, the design and production processes and the establishment of large-scale production facilities and specialized machinery tell an important story. Spanning the 1940s to the 1990s, this period marked the peak of their use and reflects a pivotal chapter in construction history [26]. These components' original cement compositions, reinforcement details, sizes, colors, and surface textures are tangible records of their design, development, production, and installation. This technical significance makes them valuable as industrial spolia.

Metals have always held significant economic value, making them precious across various professions, including architecture. Their integration into the built environment carries profound meaning, offering substantial documentary value and potential for reuse.

Ashby explored the historical significance of aluminium in architecture, tracing its evolution from early 19th-century discoveries and experiments to its widespread integration into various industries by the early 20th century [28]. Initially limited to small-scale applications, aluminium's transformative impact became most evident in the 1950s [28]. It revolutionized architectural style during this period by adopting curtain walling systems that redefined facade aesthetics and functionality. Consequently, aluminium is recognized as a historically significant material, symbolizing technological progress and a pivotal shift in architectural design. This recognition underscores its value, presenting opportunities to preserve and transfer its historical and technological significance into new structures.

De Campos highlighted the time-based associations of steel construction, particularly in restoring old buildings [29]. Traditional vernacular structures, especially rural housing, were often constructed with heavy materials like stone and brick, reflecting custom, user-specific designs. In contrast, recent residential architecture favors smaller-scale, modular designs using lightweight materials like steel [29]. De Campos emphasized how restoration and renovation projects intersect these material histories, offering designers a unique opportunity to blend and convey the stories of both traditional and modern materials within a single structure.

Xiong et al. [30] examined the historical use of steel in Chinese architecture as a reflection of Western architectural influence beginning in the post-19th century. Traditionally dominated by wooden roofing systems, Chinese architecture saw the emergence of hybrid constructions that integrated steel, particularly in composite roof trusses. These structures represent a fusion of architectural traditions, symbolizing a pivotal period in China's architectural and cultural history [30]. As such, they hold considerable representational value, embodying specific cultural preferences and offering potential as spolia elements.

In short, researchers worldwide have highlighted that construction materials and building craftsmanship encapsulate significant histories and narratives shaped by their original contexts. Salvaging these materials offers a valuable means of documentation. Accordingly, the following section explores the contextual significance of the Vityaz Movie Theatre at both urban and architectural scales, delving deeper into the history of its materials and construction techniques.

3. MATERIALS AND METHOD

Building materials hold significant information that can be uncovered through meticulous analysis and documentation of related contexts. The initial step in this process involved researching the history of urban development in the district to identify potential values supporting a spolia proposal for the materials of the Vityaz Movie Theatre. With no comprehensive dataset readily available, multiple sources were analyzed to create a foundational dataset. Subsequent stages focused on examining the building's architectural history and the related information about the production of its materials.

The Vityaz Movie Theatre (Kino Vityaz), constructed in 1970 in the Belyayevo district of southern Moscow, played a pivotal role in the area's social and cultural landscape until its demolition in 2019 (Fig. 2a). Belyayevo, originally a suburban town, was integrated into Moscow's urban core

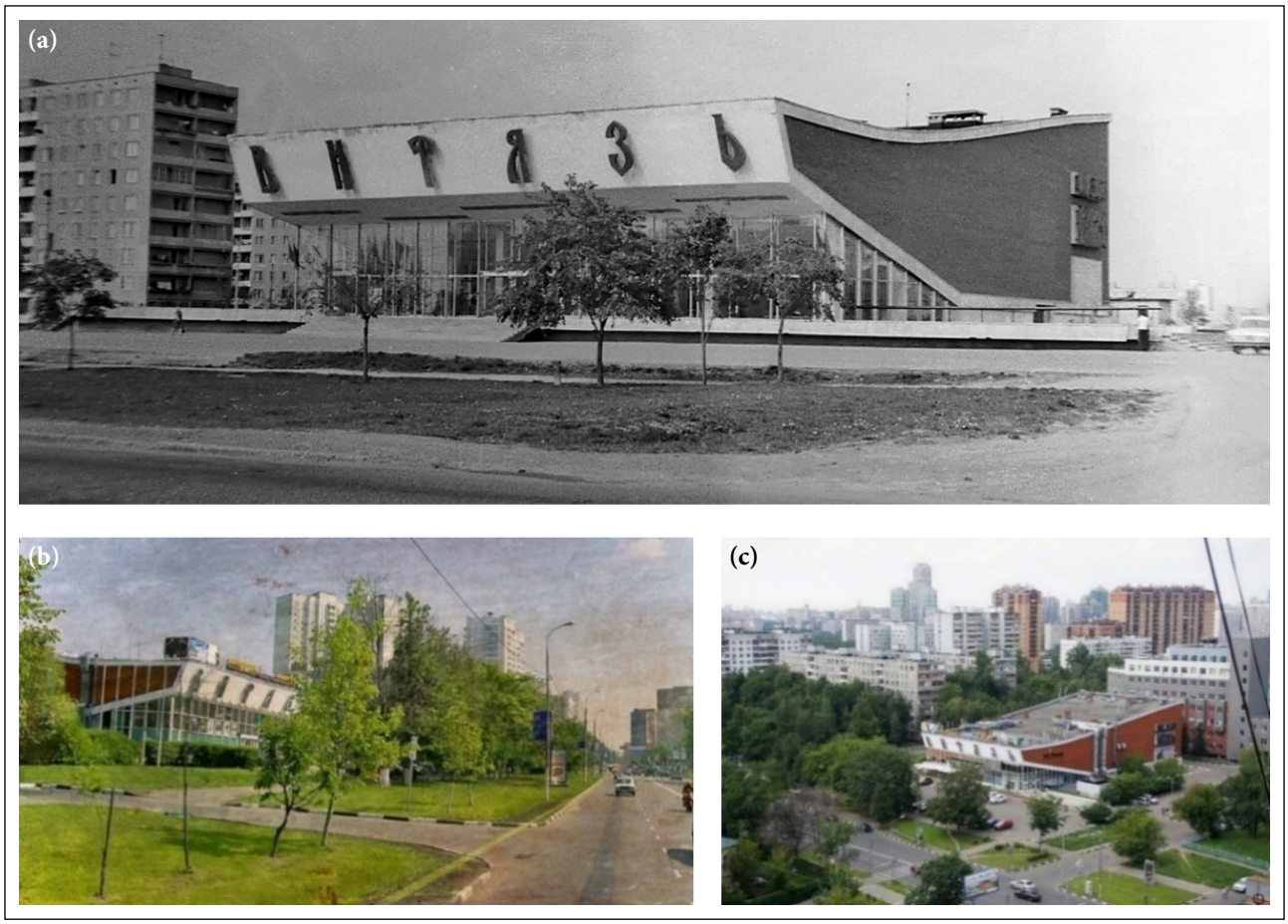


Figure 2. **(a)** The Vityaz Movie Theatre shortly after its completion in 1975 [34]. **(b)** The Vityaz Movie Theatre during the 1990s [35]. **(c)** The Vityaz Movie Theatre in the 2000s [36].

during the 1960s as part of the city's major urban expansion, known as the Belyayevo-Konkovsky urban regeneration project [31]. This project, which took shape in the 1970s, established one of the country's largest mass housing settlements alongside the development of significant educational and cultural institutions [31].

A notable addition to the district was the Peoples' Friendship University of Russia (RUDN-PFUR) campus, an institution designed to foster international connections. With multiple departments across the area, RUDN transformed Belyayevo into a vibrant educational hub, complementing its dense residential landscape [32].

The construction of the Vityaz Movie Theatre further enhanced this dynamic growth, providing a venue for social and cultural gatherings as the district's residential and academic activities expanded. The theatre became a key element of Belyayevo's architectural identity, designed by Dmitry Sergeevich Solopov and M. Kazarnovsky [33]. Their architectural approach shaped this iconic project and served as a model for similar structures across Moscow and beyond [31, 33].

Until the 1990s, the district's architectural style evolved with increased typological diversity and taller buildings. However, the design language remained consistent, characterized by straightforward forms and facades (Fig. 2b). After the dissolution of the Soviet Union in 1991, the government permitted the privatization of residential building planning, development, and ownership, marking a significant shift. This transition brought notable changes during the 2000s, including unique projects, experimental layouts, a wider variety of materials, and more elaborate decorations [37].

Since then, the area has adopted an eclectic urban design, blending architectural styles from multiple decades. Within this context, the Vityaz Movie Theatre significantly represented 1970s architecture (Fig. 2c).

The building had a footprint of around 2800 m² and reached a height of 18.5 meters at its tallest point. It was surrounded by a park, contributing to its prominence as a social and cultural destination in the district. Architecturally, the facades featured concrete components framing brick walls, creating a modernist appearance typical of Soviet-era public buildings. The entrance was designed with a glass foyer beneath the auditorium, intended to welcome the audience in a visually open and inviting manner (Fig. 2a).

Behind the building's sole auditorium, five floors of service spaces were strategically integrated, playing a vital role in the building's overall functionality. The auditorium featured a wedge-shaped design, contributing to the building's dynamic and striking architectural profile (Fig. 3). A slanted roof, supported by metal trusses, further emphasized its distinctive form. The extensive use of concrete for the flooring underscored the robust, industrial nature of the structure.

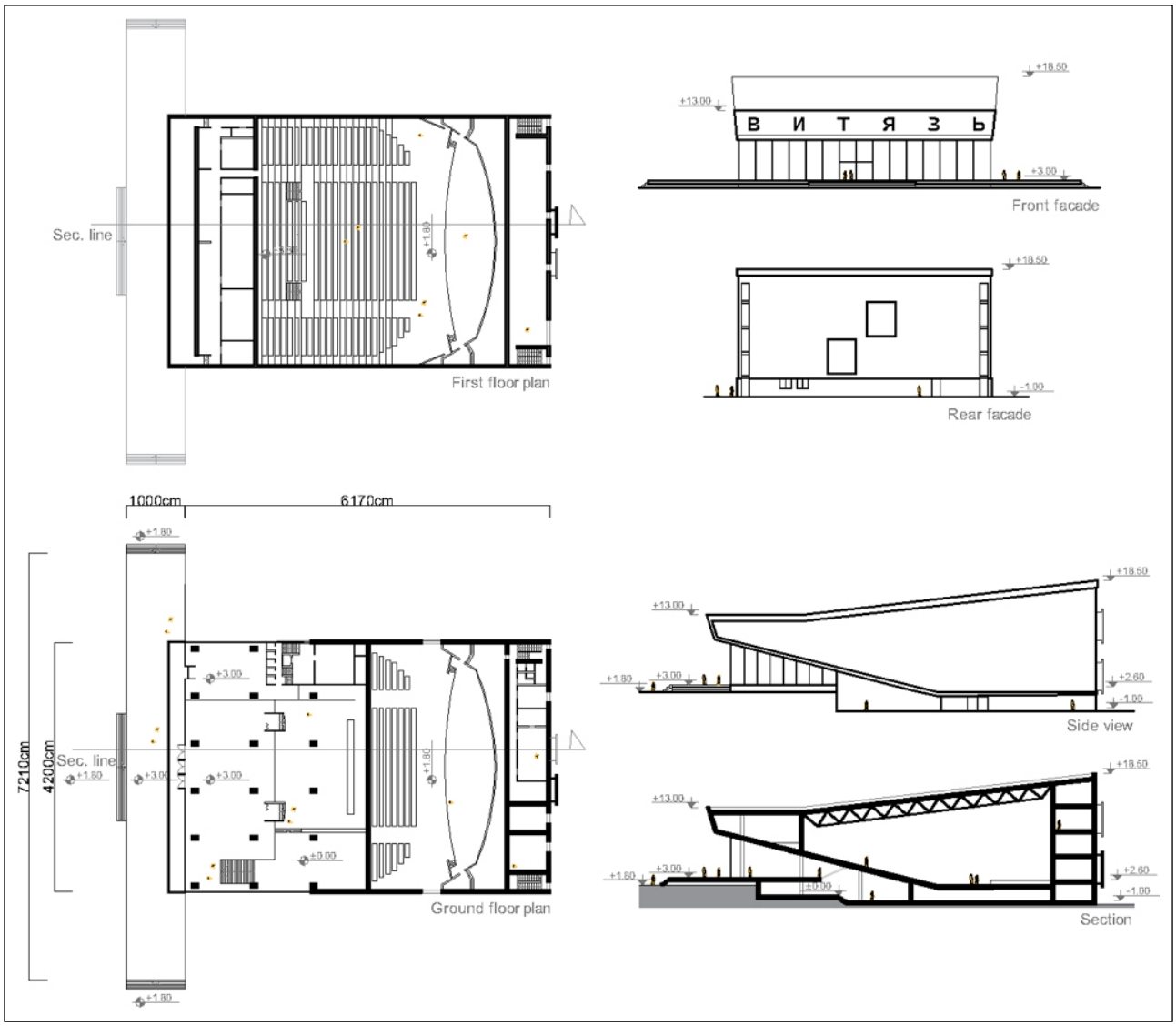


Figure 3. Technical Drawings of Vityaz Movie Theatre, produced by the author, data adapted from Ermolaev [33].

This thoughtful combination of materials and design elements ensured the Vityaz Movie Theatre's functionality and established it as a significant architectural landmark in the area. The design reflected broader trends in Soviet architecture, prioritizing practicality while incorporating elements meant to captivate and engage the public [31].

The Vityaz Movie Theatre underwent periods of fluctuation in its use and significance, experiencing both decline and revitalization over the years [37]. However, by the 2000s, it had fallen into disuse, overshadowed by the rise of modern shopping centers that included their movie theatres [37]. Despite its historical importance to the district, the building did not meet the criteria for heritage designation and was ultimately slated for demolition [37].

Demolition began in October 2019, lasting approximately six weeks. Heavy machinery was used to bring down the structure, with no prior effort to salvage individual components. As a result, brick and concrete debris were sent to a landfill, while steel and other metals were collected in bundles and sold to a recycling company for processing.

The following section presents information crucial for assessing the potential values for spolia, focusing on the production methods, stylistic qualities, and associated contextual information of three key materials: bricks, precast concrete components, and steel. The findings were gathered as an imaginary salvaging scenario that could have been especially valuable before the demolition began, allowing the components to retain helpful information for future constructions.

3.1. Contextual information associated with the walls of the Vityaz Movie Theatre

The facades of the Vityaz Movie Theatre featured expertly integrated brickwork, with the rear façade showcasing a particularly innovative design. Two projecting wall sections were placed on a large, flat surface, contributing to the building's dynamic architectural expression (Fig. 4a). While these projections maintained the appearance of a seamless brick wall, they also incorporated apertures that allowed natural light and fresh air to flow in from the sides. This design preserved privacy and met the practical needs of service areas, offices, and technical rooms.

Figure 4. **(a)** The rear façade of the Vityaz Movie Theatre was captured during demolition. **(b)** Typical fenestration openings in brick façades across the city: Orlov Paleontological Museum (1965–1989), Moscow. **(c)** Five-story mass housing was constructed in Moscow in the 1960s and 1970s.

During demolition, it was revealed that steel members were used to secure the projecting wall sections mechanically. This hidden integration of steel within the brick structure highlighted the technical sophistication of the building's original design. Using steel would have allowed for potential dismantling during deconstruction, which could have supported the adaptability and repurposing of materials.

The significance of this design solution lies in its departure from the conventional approach to fenestration openings. Wall openings, typically formed by punched holes in brick walls, were a standard feature in various building types, from modest residential buildings to large public spaces such as museums (Fig. 4b, c). However, the approach used for the Vityaz Movie Theatre clearly distinguished itself from these conventional practices.

Figure 5. **(a)** The Vityaz Movie Theatre's brick walls were captured during demolition. **(b)** Schematic drawing illustrating construction with pre-built large masonry-block wall panels [38]. **(c)** The five-story mass housing project was constructed with prefabricated large-block brick wall panels in the 1960s–70s Moscow.

Although the design deviated from common methods, using identical solid bricks and consistent bonding patterns allowed the building to blend seamlessly with the surrounding urban fabric (Fig. 5a). This integration ensured that the Vityaz Movie Theatre maintained its innovative and functional appearance while subtly reflecting its 1970s identity within the neighborhood. This balance between modernity and tradition underscored the importance of repurposing these brick walls, offering value.

The craftsmanship of the walls was particularly notable, with each brick bonded using traditional techniques, a contrast to the industrial methods that dominated the era. In the 1970s, large-scale industrial construction methods—such as prefabricated large-block brick wall panels (Stena

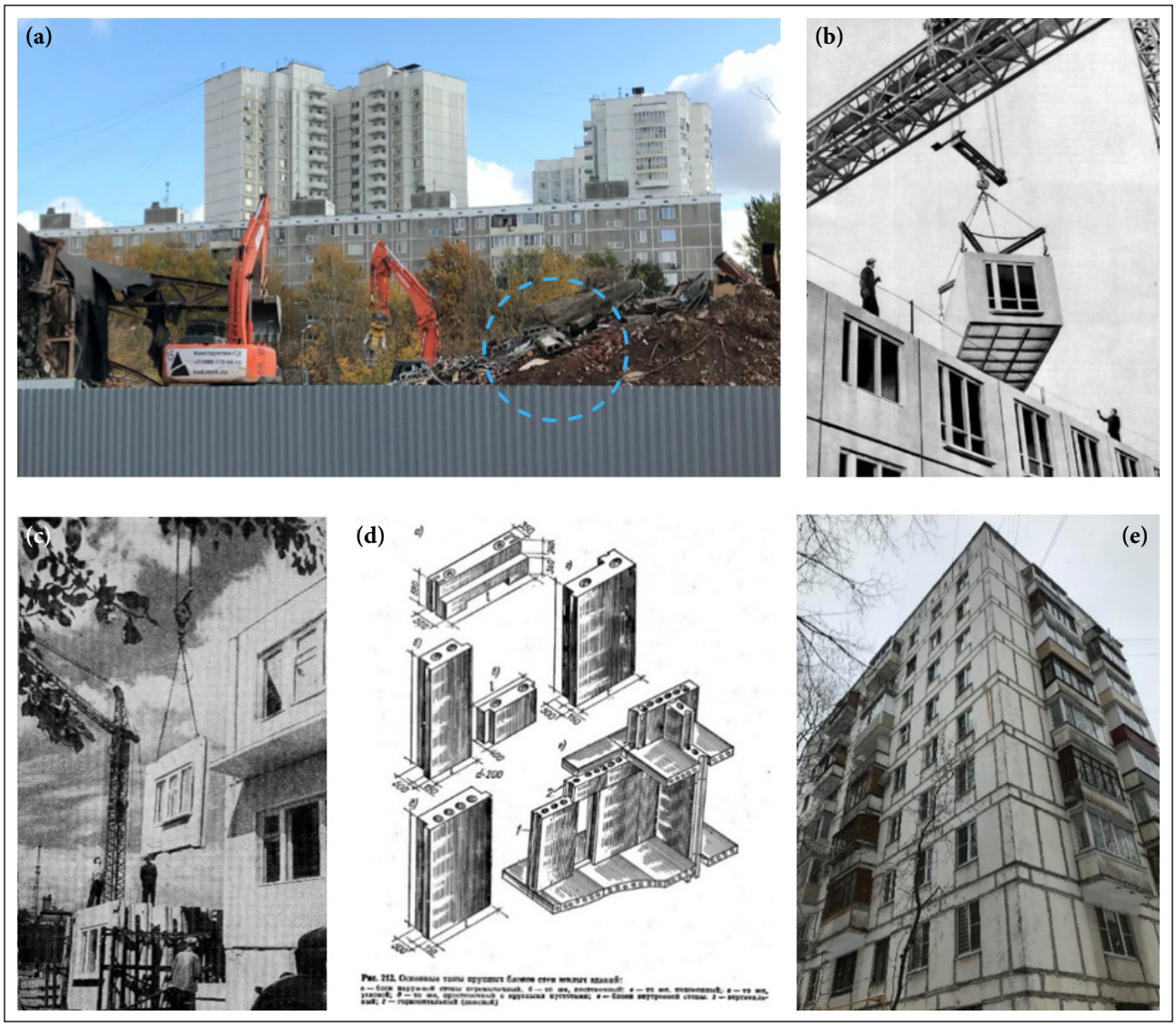


Figure 6. **(a)** The precast slab panels of the Vityaz Movie Theatre were captured during demolition. **(b)** Assembly of a residential building from prefabricated rooms in 1964 [41]. **(c)** Precast walls during construction in the 1970s [42]. **(d)** Assembly schema of precast wall panels and slab panels [38]. **(e)** A building was constructed using precast wall panels and slab panels in Moscow in the 1970s.

iz kirpichnykh krupnykh blokov, in Russian)—were widely favored [38–40]. These preferences accelerated construction, particularly in response to housing needs and the reconstruction of civic buildings following post-war destruction across the city and country.

Despite using similar materials and bonding patterns, traditionally bonded bricks and industrially produced brick panels were visually distinguishable by the horizontal and vertical joints on the façades (Fig. 5b, c). This distinction emphasized the building's departure from mass production and showcased the neat craftsmanship embedded in its walling.

As a result, these walls held significant potential for repurposing and transferring the material's original brick bonding, texture, and color.

The demolition process uncovered well-crafted brick units that comprised the entire thickness of the wall, measuring a substantial 55 cm. This resulted in many solid bricks, which were valuable for salvage. Despite the intensity of the demolition, many of the bricks remained intact, highlighting their strong mechanical properties (Fig. 5a). With proper handling, these bricks offered an opportunity to contribute to sustainability by preserving their original properties for reuse in new construction. Even simply collecting the intact bricks after demolition would have been a significant alternative to landfilling.

3.2. Contextual information associated with the floors of The Vityaz Movie Theatre

The structure's floors were constructed using standard 22 cm thick hollow-core precast concrete panels with overlapping edges, which were secured together using steel clamps embedded in a cement mixture. These panels were commonly produced components for rapid industrial construction. Throughout the 1970s, the production and

Figure 7. Steel roof trusses of the Vityaz Movie Theatre, captured during demolition.

use of prefabricated reinforced concrete elements became widespread across the country [38–40]. The production scale ranged from individual rooms to entire facades and large blocks, often enabling the construction of complete buildings with this same technique [38, 40] (Fig. 6). These prefabricated typologies became a defining characteristic of urban landscapes, significantly shaping the architectural identity of cities and districts, including Belyayevo, where the Vityaz Movie Theatre was located [31].

The rapid production, quality, and detailing of these precast components led to a significant expansion of production facilities nationwide [39]. This success garnered international attention, with delegations from various countries visiting these facilities to exchange knowledge and learn from the Soviet approach [43]. Notably, researchers and practitioners from the USA visited these manufacturing plants and gathered information [43]. This exchange underscored the global influence and interest in the country's large-scale, efficient construction advancements during the 1970s.

Similar panels used in The Vityaz Movie Theatre, assembled with highly mechanical joints, could be easily dismantled if deconstruction had been possible. During the demolition, it was observed that these panels broke into large pieces, indicating that reshaping them into new components, even after the demolition, could have been a possibility.

3.3. Contextual information associated with the roof of The Vityaz Movie Theatre

The demolition process uncovered six slender steel beams, each 45 meters long and 2 meters deep, used to span the roof of the Vityaz Movie Theatre's single auditorium. This extensive use of metal was notable, given the metal scarcity that affected many industries when the building was constructed.

While Russia remained relatively insulated from the extreme global price fluctuations of the 1970s [44], many Western nations grappled with economic challenges due to rising oil prices and supply shortages. In contrast, the Soviet Union benefited from its reserves and state-controlled pricing [44]. However, despite this advantage, the country began facing issues related to metal production levels.

During the early years of Soviet industrialization, from 1920 to 1938, steel production grew at an average annual rate of 25.5 percent [45]. This growth declined to 7.9 percent between 1946 and 1978 and plummeted to just 0.7 percent from 1978 to 1991 [45]. Following the collapse of the Soviet Union in 1991, steel production entered a period of drastic decline, marked by negative growth [45]. These fluctuations reflected broader trends in the Soviet steel industry, which were inevitably mirrored in the construction sector.

Given this context, the generous use of steel in the Vityaz Theatre was interesting, as including such large quantities of metal became increasingly rare in later years. This information made the steel components particularly valuable for salvaging, as they also carried an additional narrative linked to the country's metal production history.

The exposed steel trusses that formed the auditorium's roof created a skeletal transparency, contributing to the light and airy atmosphere of the Vityaz Movie Theatre (Fig. 7). These beams were prefabricated by welding together L-shaped profiles of various sizes. During the demolition process, the quality of the metal and the joints appeared satisfactory, with partial sections remaining intact even after impacts from the machinery. As a result, these trusses seemed well-suited for resizing into shorter components for less strength-demanding functions.

After identifying significant spolia potential through inspections of three key materials—brick, precast concrete, and steel truss—within the scope of the Vityaz Movie Theatre demolition, this potential was further explored through two main steps. The first step involved calculating the quan-

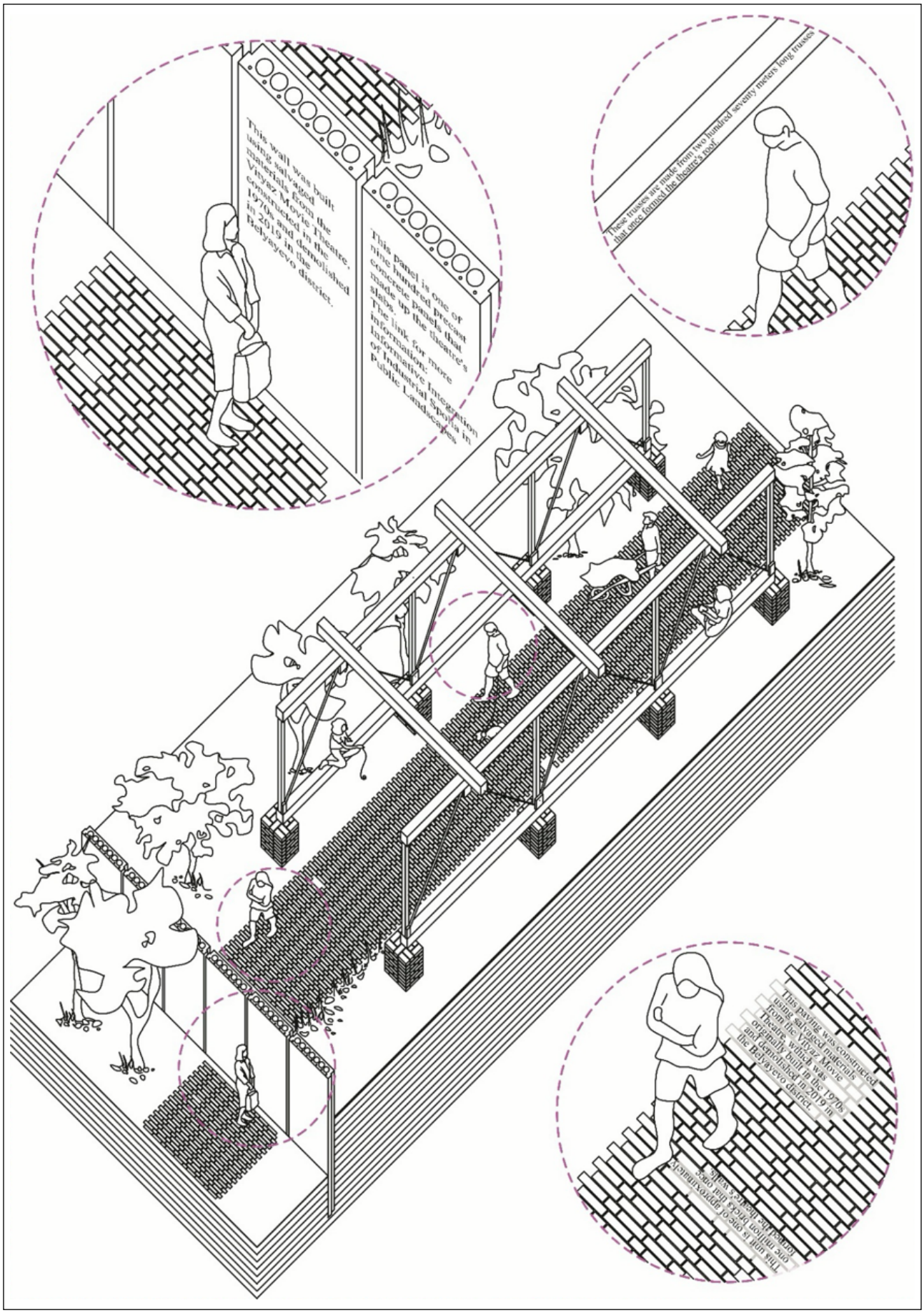
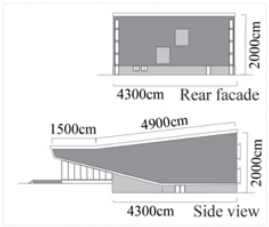
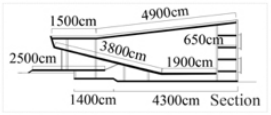
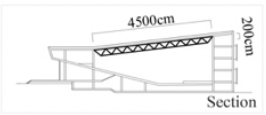


Figure 8. A sample spolia project for a public landscape using components recovered from Vityaz Movie Theatre.

Table 1. The material stock calculation for the Vityaz Movie Theatre: Brick walls, precast concrete slabs, and steel trusses

Material	Properties	Dimensions	Location	Related Drawings	Details	Calculation	Total amount	Notes
Brick	Solid	12×25×6.5cm bricks, 55cm wall thickness	Wall		Rear façade + Equally large interior service wall + Two side walls	0.55m × [2 × (43m × 20m) + 2 × (~46m × 20m)]	1958 m^3	About one million bricks
Concrete	Reinforced, precast panel	120×900×22cm	Slab		Sectional dimensions × 43m building width	43m × [25m + 14m + 43m + 19m + 38m + 15m + 49m + 4 × (6.5m)]	9847 m^2	About nine hundred panels
Steel	Truss	20×4500×200cm truss dimensions	Roof		Six trusses	6×45m	270 m	About three hundred meter long truss

tity of materials to assess the actual potential material stock within the building. This process represents urban mining, where the volume and essential characteristics of the materials were cataloged and presented in a chart of the results section (Table 1). CAD drawings played a crucial role in aiding this calculation.

The second step involved developing a conceptual public landscape project that integrated the studied materials. In this phase, the identified contextual values were used to inform the public about their significance, highlighting discovered narratives. The results section presents the outcome as a 3D model; text-based explanations are engraved on the materials (Fig. 8).

4. RESULTS

The collected data revealed that the Vityaz Movie Theatre played a crucial role in shaping the urban landscape of its district over several decades. It served as an extension of the nearby university buildings and contributed to the area's evolving residential character. Additionally, it stood as a significant landmark within the country's largest urban transformation project. Architecturally, the theatre reflected the design trends of the 1970s, with its massing and structural system holding substantial value. The materials used in its construction also provided significant insight into the period, both nationally and internationally. As a result, the theatre's demolition represented a loss of documentation on multiple levels.

Since demolition was inevitable, salvaging materials during the deconstruction process was emphasized as the only viable way to preserve this building's memory partially.

From another angle, the calculated material quantities highlighted another key aspect of the salvaging effort (Table 1). The volume of embedded brick was estimated by examining the façade, rear and side walls, and the interior service walls. With a wall thickness of 55 cm, it was determined that the building contained approximately 2,000 m^3 of brick—equivalent to about one billion bricks.

Based on the building's sectional dimensions and length (approximately 43 meters), calculations for the precast components revealed a substantial quantity of around 9,000 m^2 of slab panels—equivalent to about 900 individual panels. Additionally, an analysis of the building's roof beams, derived from sectional drawings, showed approximately 300 meters of steel trusses across all six members.

In summary, the combination of significant material stock and the documentary value associated with the building components highlighted the importance of developing a salvaging and reuse strategy for the building.

The documented materials and their properties suggested various reuse possibilities. For example, the precast slabs could have been repurposed for similar applications in ongoing urban housing projects, either as slab components or for paving surrounding open-air spaces. The thick masonry walls, in turn, could have been used as load-bearing elements or sliced into new partition walls. Dismantling the steel trusses into smaller profiles would have allowed them to be reused as beams.

Industrial-scale construction is another potential application for the salvaged precast panels and brick walls. The heavy brick walls could have served industrial facilities requiring large, durable blocks. At the same time, the slab panels would have been suitable for indoor and outdoor applications, such as in warehouses. Due to their size, the steel trusses could have been easily integrated into the roofs of such structures without further modification.

While these repurposing options maximize material reuse and minimize waste, they may limit the expression of the building's original context. Salvaged components

might be buried beneath new layers during construction, losing their ability to convey the building's history to a wider audience.

To address this, a design approach prioritizing the saving and expression of the building's values is ideal. Public access to these reused materials can foster a sense of shared ownership over the building's unregistered legacy. An inviting public landscape design could integrate these materials to allow the community to experience and interact with them.

A sample landscape design was developed to demonstrate this concept, focused on three key materials from the Vityaz Movie Theatre and commonly used in park projects (Fig. 8). First, the sliced brick walls were repurposed as pavement for walking and jogging paths, allowing visitors to experience the material and craftsmanship of the era. Information was engraved on the surfaces, educating visitors about the demolished building's history as they walked.

Second, the precast concrete slabs were repurposed as retaining walls to manage the park's topography. These elements offered clean surfaces where text and drawings could be engraved, providing context about the materials' origins and connection to the former theatre.

Lastly, the steel trusses were integrated into semi-open gathering spaces, providing shaded areas for public enjoyment. These trusses served a functional purpose and acted as historical markers, with attached details explaining their original use on the roof of the demolished theatre.

These text-based integrations helped inform the community about the materials' previous life cycle and their role in both the urban and architectural history of the Vityaz Movie Theatre.

5. DISCUSSION

Reputable literature highlights various aspects related to spolia, with the first referring to older examples where the materials themselves bear significant traces of their previous life, such as inscriptions from an earlier culture or unique iconographic representations. The pieces retain strong heritage values and cultural connections in these cases, even when completely removed from their original context. Another form of spolia involves materials or craftsmanship that impart uniqueness or vernacular quality, even though they are more commonly found. The materials may still show faint traces of their previous use. The third category, often termed "modern" or "industrial" spolia, refers to mass-produced components, where tracing any contextual value or connection to their prior life is complicated. For these materials, associated heritage value is often absent; however, they can still be salvaged, providing valuable information about the buildings they were once part of. This can be especially important for documenting buildings lost to new construction or preserving elements of buildings deemed significant to a neighborhood, city, or nation but scheduled for demolition. Researchers emphasize the importance of incorporating text-based labels on salvaged industrial spolia, much like museum objects, to help the public understand their significance.

The Vityaz Movie Theatre falls into this final category, having been demolished despite its rich historical significance on multiple levels. Built-in the 1970s using mass-produced materials, the spolia project developed for this report incorporates textual explanations to provide context for these materials. Additionally, the salvaged items were proposed for placement in an accessible public space, enhancing the potential audience and fostering a sense of shared ownership.

6. CONCLUSION

This study significantly contributes to the creation of architectural and technical drawings of the Vityaz Movie Theatre, a previously undocumented structure that has now been lost to demolition. The comprehensive documentation, including photographs taken throughout the demolition process, preserves the building's historical and architectural details, highlighting its importance to the district's development as an archival record.

Another key contribution is developing a sample project utilizing materials salvaged from the Vityaz Movie Theatre. This project addresses the general needs of a park, maximizing the potential of the recovered materials for use in various neighborhood parks and strengthening the sense of collective memory within the community.

The third contribution involves discussing the balance between the material value of the salvaged components and their documentary value, which are often intertwined. While projects focused on maximizing material value might obscure the tangible characteristics of the recovered components, this study stresses the importance of maintaining a balance—preserving material value while ensuring that the historical narratives remain recognizable.

Finally, the research emphasizes the need for a carefully managed end-of-life process for buildings of local significance. This process enables thorough historical study and on-site examination of materials, supporting sustainability across environmental, cultural, economic, and social dimensions. Such an approach maximizes valuable parameters at every stage—from identification and documentation to recovery and reuse.

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ETHICS

There are no ethical issues with the publication of this manuscript.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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