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Preserving the past or past preserving: sustaining the legacy of postmodern museum architecture

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Abstract

The publication of *Complexity and Contradiction in Architecture* in 1964 signaled the end of Modernism. The reality was that the modern movement had already jettisoned its ideological underpinnings and had become merely another 'style.' The avant garde architects in Europe and in North America were ready to move on and saw Postmodernism as a liberating antidote to the strictures of high Modernism. Historic architectural styles, which had been vilified as antiquated and out of step with modern culture, were revived, reinterpreted, and manipulated. However, Postmodernism, which had burned brightly during the 1970s and 1980s, was superseded by other architectural movements, namely, Deconstructivism, Pluralism, during the waning years of the 12th century.

Even though new building forms and design theory changed during Postmodernism, building technology remained the same. Exterior walls continued to be built as skins, comprised of either glass, masonry, metal, or synthetic cladding, which were hung of steel or concrete framing. Rubberised membranes covered essentially flat roofs. Moisture infiltration was managed in ever complex composite wall assemblies. More important, environmental systems decoupled nature from interiors and were designed to manage ever demanding humidity control requirements. Through the development of new building technology, Modernism severed design style from traditional construction. In re-introducing historical forms back into architecture, Postmodernism complicated constructability. Moreover, Postmodernism and its successors rarely developed new technological ideas by introducing more intricate building forms, which were based on theoretical ideas rather than technical ones, while continuing to employ Modernism building technology into their buildings. This inherent paradox is the most consequential challenge in preserving Postmodernism. Today, approximately 40 years after its inception, we must consider if, in some cases. is it tenable to preserve Postmodern buildings?

This paper reassesses three museums of the Postmodern era through the twin lenses of historic preservation and their legacy as cultural artifacts. It analyses how three iconic Postmodern museums, the Wexner Centre for the Arts in the USA, the Neue Staatsgalerie in Germany, and the Hedmark Museum in Norway, became cultural artifacts and how each of them present technical challenges for their future preservation. These museums represent late 20th century theoretical ideas, which were more a melding of pluralistic influences than design ideology, and the utilisation of Modernist technology. All of which present unique conditions for conservation.

Keywords Postmodernism, Modern movement, Preservation, Museums, Materials, Technology, Moisture, Memory, Adaptation

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1 Introduction

Beginning with Viollet-le-Duc in France and John Ruskin in the United Kingdom in the 19th century, preservationists, architects, and historians have applied a science-based approach often inserting new physical elements to conserve historic buildings and monuments for future generations (Vaccaro 1996; Jokilehto 2007).

Conservationists and preservationists have encountered challenges in restoring or adapting each new generation added to the built patrimony. Many of these buildings, sites, and monuments contain important legacies about the eras and cultures for which they were constructed and lessons for future architects, planners, cultural historians, and others who study them and apply their principles (Plevoets and Van Cleempoel 2012; Wong 2016). More recently, preservationists have turned their attention to postmodern buildings created during the 1970s and 1980s. Unlike older, pre-modern buildings that were constructed with robust materials, such as masonry, stone, and heavy timbers, and natural passive ventilation and daylighting, postmodern buildings were built with modern, lighter and less durable materials; complex heating, ventilation, and air conditioning (HVAC) equipment; and, sophisticated lighting and communication systems.

The hallmark of modern architecture has been 'form follows function' in which the building manifested the essential requirements of human occupation, use of industrial materials and components, and integration of state-of-the-art technology and building systems (Sullivan 1965; Gombrich 1978). Postmodern architects, critical of the inherent abstraction and machine analogies of the Modern Movement, eschewed the 'rationalism of the engineer' and manipulated historical building styles, forms, and elements to reinstate architecture with traditional syntaxes and meanings that, ostensibly, could be universally understood. Ironically, these manipulations produced even greater complexity with buildings overlaid with pastiches of stylistic borrowings that offered critiques of architecture from within its own privileged culture in a coded language that only the initiated could decipher. Furthermore, they often used inexpensive materials, such as synthetic stucco, applied over exterior insulating finish assemblies, to simulate historical details such as dentils, architraves, ornamental cornices and the like. Consequently, rather than building to withstand the 'test of time' and endure for centuries, postmodern architecture was often built within the framework of 'Life Cycle Assessment' (LCA), a twentieth and 21st century methodology that considered a 'cradle-to-grave' building existence. Through the use of materials, created to eventually decay, and construction financing, based on building depreciation, building obsolescence became a design criterion (Buyle, Braet, and Audenaert 2013). In the late 20th century, architects, engineers, building components manufacturers acknowledged in their designs that the buildings they were designing were built for a 30 year lifespan. Today, preservationists grapple with the challenge of conserving buildings that were designed and built to eventually fail.

As architects and preservationists consider how to preserve postmodern buildings and its legacy, they must also ask to what extent are postmodern buildings worth preserving? As this paper shows, not all postmodern buildings should be preserved due, primarily, to complicated and poor construction techniques, use of inexpensive non-durable materials, and expensive retrofitting of inefficient HVAC, lighting, and information systems. Buildings that can and should be preserved are those that have been constructed with more durable materials, less complicated construction processes, and sustainable building systems.

Museums are often iconic heritage buildings that give identity to cities and communities, so many preservationists argue that these buildings be preserved or reused for present and future generations (Jacobs 1961). But what happens when buildings have been constructed for obsolescence? This paper analyses how three iconic Postmodern museums, the Wexner Centre for the Arts in the USA, the Neue Staatsgalerie in Germany, and the Hedmark Museum in Norway, present technical challenges for their future preservation.

2 From modern to postmodern

The ideological underpinnings of the Modern Movement began in the late 19th century with industrialisation and the introduction of new building materials, particularly cast-iron, glass, and steel.[1] These revolutionary materials allowed architects and engineers to create lighter, stronger, and more efficient buildings. Architects grappled with the problem of how to aesthetically express these new, modern technologies.

The purest expression of modern skeletal construction was achieved by Joseph Paxton in the Crystal Palace constructed for the Great Exposition of 1851 in London. Paxton first explored the ideas that led to the Crystal Palace with his greenhouse design for the Duke of Devonshire at Chatsworth—it was inspired by the vascular section of a water lily—the Crystal Palace was a prefabricated building of cast iron components and glass. Its form follows function approach to design and aesthetics became the

[1] Despite technological advances, the idea that history and civilisation were inherently progressive came under scrutiny. Consequently, some historians see Modernism as a continuation of Romanticism's revolt against industrialisation and bourgeoise values.

model for many subsequent modern buildings of the 20th century[2] (Le Corbusier 1985).

The 1939 MOMA exhibition in New York City and eponymous catalogue *The International Style* presented modern architecture as a unitary style global in scope (Johnson and Hitchcock 1939). However, by the early 1960s, the ideology of the Modern Movement had waned. The notion of a transcendent universal 'style' dictated by function and perfected through technology ultimately led to ubiquitous and monotonous concrete- and steel-framed buildings clad in glass curtain walls.

Robert Venturi took issue with modernism's anti-historical stance in *Complexity and Contradiction in Architecture* where he derided the stripped-down functionalism and brutalism of modern buildings declaring 'less is a bore' (Venturi 1977). Instead, he turned to Mannerism where post-Renaissance architects manipulated rules of proportion, scale, and composition and elements for aesthetic effect and personal expression. The house he designed for his mother was a complex amalgamation and abstraction of architectural styles, motifs, and elements that could be intelligibly deciphered and decoded by the educated eye yet comprehended by the public.

The prevailing myth that Modern architects rejected history served to distance modernism from the past and its cultural baggage. Within the postmodern strain of historicism, functional pragmatics and material construction returned. Longstreth (2000) postulates that 'History was welcomed back [during the Postmodern Movement] as a counter to abstraction.' However, the willingness of postmodern historicism 'to ransack history revealed [itself] in its vocabulary as fundamentally disrespectful of history, and even more disrespectful of the present' (Longstreth 2000). As Anthony Vidler 193) contends the modernists understood history as the Zeitgeist of a new age enacting social change. Conversely, the postmodernists embraced an 'ahistorical myth' in which they selectively used whatever authorising sign to fit the moment.

3 Problems in conservation and construction

Like most historic buildings, postmodern architecture faces the same three major threats: demolition, deferred maintenance and alteration/loss of integrity (Saunders 2019). Grignolo (2018) argues that recent past buildings should not be considered merely for their aesthetic features; they also have to do with physical well-being, social rituals and representations, as well as with associated concepts such as values and emotions, as a historical, symbolic and aesthetic resource, but also as being endowed with social, economic and ecological value. This raises a fundamental question: Does the building or the design idea hold supremacy in conservation, restoration and reuse?

In the case of postmodern architecture discussions are exacerbated both by the material, technical and functional fragility of this heritage, and by the growing importance that historiography attributes to the idea and design phase of the architectural work. By simple virtue of their own longevity, surviving neoclassical and other historicist monuments have already shepherded themselves into the pantheon of history. Their materials and methods of building are different enough from our own to distill the particulate of theory, fabric, and history into the distant past and the now (Rogers 2011). In contrast, many postmodern buildings were built with temporality in mind designed by architects who were often constrained by limited budgets and more concerned with composition than posterity.

Postmodern architects, engineers, and material suppliers were pushing new materials and innovative construction technologies as a way to create Postmodern design elements (Meijer 2016). Continuous innovation in building skins reintroduced porcelain enamel panels, a product brought by Lustron to the building industry during the housing boom following World War II. New skins made from Glass Fiber Resin (GFR) capable of being molded in classical curves and ornamental shapes favored by Postmodern design were created. Innovations in brick technology including large scale brick panels made from a single wythe of masonry to panels whose outer face was only one-half inch of masonry, or thin bricks. Improvements in resins created new wood or simulated wood products and adhesives for mounting faux finishes to structural systems. Perhaps one of the more ubiquitous new materials used in the creation of Postmodern architecture was the faux stucco product Dryvit,[3] an Exterior Insulation Finishing System (EIFS). Like porcelain enamel panels, EIFS was introduced as insulated wall assemblies as a means to improve energy performance during the world's energy crisis of the 1970s.

In order to conserve delicate and often priceless artwork, museums require constant indoor air

[2] Mies van der Rohe embraced the 'honest' expression of materials and details in ground-breaking buildings, such as the German Pavilion (1929) in Barcelona, Spain and the Farnsworth House (1951) in Plano, Illinois. Le Corbusier argued for a program of pragmatic rationalism reflecting the 'aesthetic of the engineer' in Towards a New Architecture. His villa architecture of the 1920a and 1930s extolled the efficiency of the modern machine age and expressed domestic architecture as a 'machine for living.'

[3] 'Dryvit' is a proprietary name of an Exterior Insulation Finishing System. Tremco Construction Products, Inc. owns Dryvit Systems.

temperatures of 70° F and humidity levels of 55%[4] (Thomson 1978, 114; Schellen and Martens 2008). The composite walls of many postmodern buildings—comprised of thin veneer-like cladding materials sealed with caulk, fiberglass batt insulation, and interior finishes all sealed within permeable vapor barriers—tend to allow moisture migration into wall cavities. Uncontrolled moisture is the most prevalent cause of deterioration in older and historic buildings (Park 1996). It leads to erosion, corrosion, rot, and ultimately the destruction of materials, finishes, and eventually structural components. Ever-present in our environment, moisture can be controlled to provide the differing levels of moisture necessary for human comfort as well as the longevity of historic building materials, furnishings, and museum collections. The challenge to building owners and preservation professionals alike is to understand the patterns of moisture movement in order to better manage it—not necessarily to eliminate it.

Because the materials and construction used in postmodern buildings are dictated by LCA rather than longevity, we must consider the problem of authenticity when preserving them. In other words, should the same materials be used to maintain the buildings' provenance even though they are inferior? Grignolo (2018) points out that authenticity contributes to the 'making' of buildings as well as heritage. This notion is crucial in the theory and practice of conservation and it was codified and challenged in Nara Document on Authenticity, which expanded the idea of authenticity to include building technology and design as heritage. In the case of Modern and Postmodern architecture discussions are exacerbated both by the material, technical and functional fragility of this heritage, and by the growing importance that historiography attributes to the idea and design phase of the architectural work. The latter is apparent in an increasingly frequent interest for posthumous reconstructions or constructions, borderline cases in which authenticity is reduced to the idea. David Lowenthal stated it best, 'Authenticity is in practice never absolute, always relative' (Lowenthal 1995).

Many Postmodern buildings incorporate systems or components that are neither produced nor currently assembled in similar manners due to improvements in technology and building envelope science. Therefore, the process and method of building restoration, rehabilitation, and/or focused envelope repair could dramatically impact the exterior character of Postmodern structures, which can have a negative impact on the authenticity and historical value of the buildings as artifacts (Meijer 2016).

[4] Most of these guidelines are derived from 'The Museum Environment' from Thomson from 1978. In this edition 55%RH is a recommended mean value for mixed collections, with acceptable deviations from plus or minus 5%RH. Thomson himself indicated that these deviation values were not based on pure research, but that these were values that were feasible for the HVAC systems from that time.

4 Re-interpreting the past

Postmodernism is 'an eclectic and colorful style of architecture and the decorative arts that appeared in the late 1970s and continues in some form today' (RIBA 2021). Some of its architectural characteristics include polychromatic cladding materials, thin-cut stone, and exterior insulated panels covered in thin-coat plaster that could be shaped, molded, and painted. Steel structural framing allowed architects to suspend and layer lightweight materials to create spatial and three-dimensional effects and scalar transitions from building entrances and street facades to horizontal cornices and entablatures to skyscraping crowns.

Venturi later complained that his intentions had been misinterpreted (Kahl 2008). He recognised that most people yearn for the use of understandable symbolism within their buildings. Therefore, regional architecture was good architecture. On the other hand, the self-referential codes, exaggerated scales and proportions of architectural elements such as columns, pediments, and entablatures, and the layered collages and patterns of materials and colors reduced buildings to kitsch and vulgar expressions of low-brow culture and cast many Postmodern buildings as expendable commodities of consumer culture.

In essence, architects were merely applying (arguably too literally) the lessons Venturi, Izenour, and Scott-Brown presented in *Learning from Las Vegas* (Venturi, Scott-Brown, and Izenour 1977). The place-less-ness and banality of the Las Vegas strip, which had become the ubiquitous consequence of the American automobile age, reflected the post-World War II U.S. cultural shift from rootedness to mobility. Inexpensive, functionalist, box-like buildings with applied bill-board facades illuminated by neon viewed from a moving automobile became a form of advertising and branding writ large. Architects parodied the exaggerated advertising techniques that had already pervaded radio, television, and mass communication in extravagantly designed Postmodern buildings.[5]

By contrast, some European and Nordic architects took a different approach in which past and present coexist. Adaptive reuse of older buildings and reinterpretation of modern design and aesthetic principles combined with regional and cultural attributes have enabled designers to

[5] In 1983, Ricardo Bofil applied exaggerated-scale classical elements to the facades of a Beaux Arts inspired public housing complex Les Espaces d'Abraxas on the outskirt of Paris. Michael Graves parodied the caryatid columns of the Erechtheion with the Seven Dwarfs orders in the Team Disney Building in Burbank, California in 1990. The New York-based firm SITE manipulated the facades and corners of the Best department stores. And in Chicago Stanley Tigerman applied a cutout façade of a dog face to an otherwise non-descript Anti-Cruelty Society Animal Shelter in 1980.

endlessly adapt buildings to the exigencies and *genius loci* of climate, culture, and place (Giedeon 1941; Norberg-Schulz 1979). This process ensures that as old buildings are repurposed or new buildings are constructed their relationship to the land, people, and environment will not be compromised or jeopardised. Rather than conforming to fashion, contextual architects took a longer and more measured view of the cultural and environmental consequences of design and building.

5 Three postmodern museums

Museums, concert halls, and theaters are among the most significant cultural institutions and, by their nature, should be maintained and preserved for posterity. Classically designed buildings constructed of durable materials seldom go out of style; hence, they transcend their own epoch. The question is: what happens when style trumps constructability? When buildings become expendable commodities subject to changing trends, they become tropes that lose continuity with the past and their purpose and inevitable preservation become questionable.

The Wexner Centre for the Performing Arts at Ohio State University and the Neue Staatsgalerie in Stuttgart, Germany were critically acclaimed for their avant garde, postmodern designs when they were opened to the public. They represented the epitome of architectural art where design trumps technology. In contrast, the Hedmark Museum at Hamar, Norway preserves the archeology of the Bishopric ruins and the display of its artifacts. Built over the course of three decades, it exemplifies the timelessness of thoughtful design realised through organic materials and points the way toward preserving the past with sustainable architecture.

5.1 Wexner Centre for the Arts

Designed by Peter Eisenman in 1989, the Wexner Centre for the Arts (the Wexner) at The Ohio State University (OSU) (Fig. 1) was dubbed by critic Paul Goldberger 'The Museum that Theory Built' (Goldberger 1989). A contemporary art laboratory, it was one of the first deconstructivist buildings to be built in the U.S. (Grimberg 2012). Deconstructivism is a postmodern style that exhibits fragmentation and distortion of structure, as if taking a coherent building apart and then chaotically reassembling it. To concentrate attention on his formal investigations, Eisenman has adapted a revision of the International Style that he calls 'cardboard architecture' (Fig. 2) (Gebhard and Nevins 1977).

Buildings continuously experience different types of deterioration, including aging, weathering, and depletion by use (Jokilehto 2007). The level of building wear

Fig. 1 Wexner Centre for the Performing Arts, The Ohio State University, Columbus, OH. Peter Eisenman Associates architects (Source: Columbia University Avery Library)

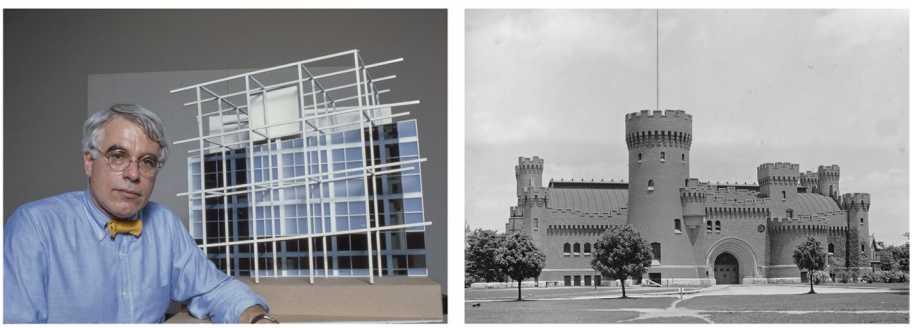


Fig. 2 Left: Peter Eisenman with model of the Wexner Centre for the Arts. Right: the Armory Building, Ohio State University, Columbus (Source: Library of Congress)

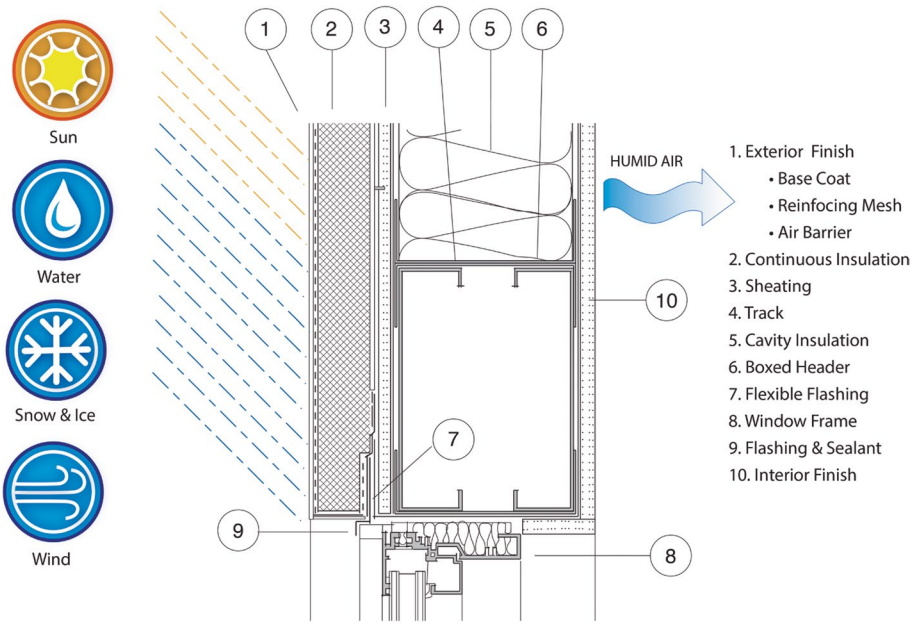


Fig. 3 Typical EIFS wall section. EIFS is an economical exterior cladding system that can be compromised by ultraviolet sunlight and weathering from rain, snow, ice, and wind introducing cold dry air during winter months or warm humid air during summer months into interior rooms. (Source: the authors)

depends on structure, materials, and maintenance, so repair techniques may vary as a consequence based on diffferent beuilding cultures and technologies. The Wexner Centre was constructed around a structural steel frame, providing a 'scaffold' on which other materials are then applied.

Shortly after it was opened, the Wexner began having problems due to its complicated construction (Jones 1990). Too much light entered the building for the exhibit of art. Heating and cooling systems were inefficient in the 1980s. Furthermore, the detailing of complex tubular steel scaffolding and volumetric building masses were never completely resolved (Ohio History Central 2021; Pogrebin 2005).

The Wexner Centre uses an Exterior Insulation Finishing System (EIFS), which is rigid insulation coated with a thin layer of stucco for exterior cladding (Fig. 3). EIFS is relatively inexpensive and, because it combines both insulation and exterior finish, reduces construction time and costs. However, it can be easily damaged allowing water to infiltrate behind the panels. Other problems include incorrect selection or application of sealants, or missing sealants, which provides an easy path for water entry and premature deterioration. A base coat that is too thin provides insufficient waterproofing protection, whereas a base coat that is too thick may lead to cracking (Sanders and Robinson 2014).

In the midwest, where temperatures can vary seasonally by 100 °F (38 °C) or more, water will freeze during the winter and thaw as temperatures rise in the spring causing separation of the stucco from the insulation of the panels and oxidation of the metal hardware that anchors the panels.

The gridded steel scaffolding around the building and the skylighted 'spine' along its main circualtion axis are exposed to the elements inviting multiple problems related to thermal expansion between the steel framework and glazing as well as between the building and the scaffolding. Other issues include a leaky roof caused by the crooked intersection of planes, and material issues at other areas in the building. Skylights let in too much direct sunlight, causing damage to artwork in galleries and temperature fluctuations of up to 40 degrees indoors (Grimberg 2012). Thermal bridging[6] caused by the emergence of the steel spine at the entrance of the building allows cold air to migrate through the structure into the building during winter months. Thermal bridging can be prevented by breaking the connection between outdoor and indoor componets, but Eisenman, who is a formalist, was not concerned with the Wexner Centre's 'technical issues': 'There's not an architect I know that doesn't have problems with important buildings' (Pogrebin 2005).

Human comfort and function are the primary reasons for constructing buildings. Yet, Eisenman placed

[6] Thermal bridging is the movement of heat across an object that is more conductive than materials around it. The conductive material creates a path of least resistance for heat. This phenomenon has become common in multi-component contemporary wall assemblies. Charles Binggeli (2010). *Building Systems for Interior Designers.* Hoboken, NJ: John Wiley & Sons.

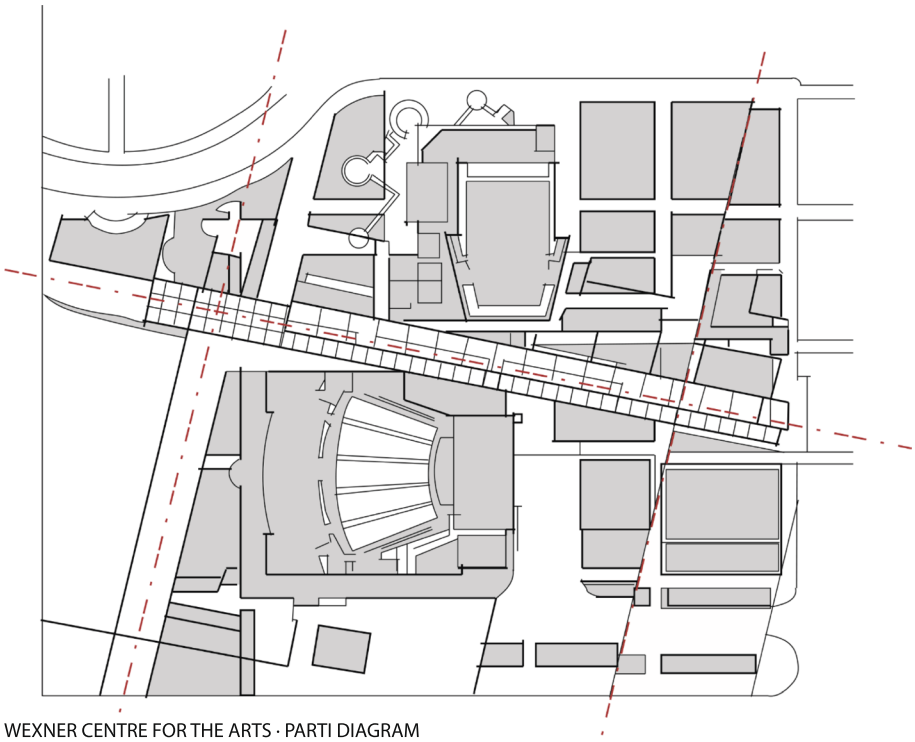


Fig. 4 OSU campus plan c. 1998 (left) and organisation diagram and section of the Wexner Centre for the Arts (right), The Ohio State University, 1989. (Source: the authors)

less emphasis on these important design factors in favor of formal manipulations of grids and interior spaces to 'unsettle' perceptions of the building (Langdon 2014). This objective is candidly embraced by the OSU administration, which values the Wexner Centre's 'daring design' (Wex 2021).

The Wexner Centre includes a theater, art galleries, and studios each requiring different lighting, acoustical, and mechanical environmental control systems (Fig. 4). The efficiencies of these systems are constantly changing so they need upgrading and replacement as they wear out. Humidity and constant temperatures must be maintained throughout the building, especially in art galleries. Thus, maintaining and replacing the Wexner Centres mechanical systems is also costly.

The Wexner site was originally occupied by the Armory Building that was razed (Fig. 2). Eisenmann reconstituted its foundation and its red-brick turrets as Postmodern ruins.[7] One of the turrets is sliced by the grid shift with the two halves offset from one another. The re-imagined brick-clad remnants of the Armory Building are also a nod to the traditional red brick buildings that dominate the OSU campus, whereas the aggressive steel grid armatures that interpose on interior spaces sets it apart. The slicing of the turrets invites more problems with water infiltration, uneven settlement of foundations between the turrets and other building elements, and deterioration of the brick cladding due to spalling of the brick surfaces, as a result of water damage, and effervescence of

[7] There are two versions of the Armory foundations. In one version, the existing foundations have been incorporated into the new building. In another account, the original foundations were demolished when the site was cleared and had to be rebuilt.

Fig. 5 Neue Staatsgalerie, Stuttgart, Germany, 1984. James Stirling & Michael Wilford architects. (Source: Columbia University Avery Library)

the mortar joints resulting from leaching of the lime from the mortar itself.

The amalgam of elements and quotations give the building a collage-like feeling reflected in Eisenman's drawings and supported by the jury's observations that 'the design proposal affirms the interactive roles of memory and invention as catalysts for the visual arts' by provoking speculation and uncertainty. Thus, he coyly integrates occupants' experiences of the building with its campus environment while simultaneously making the users aware of its formal manipulations thus dislocating it in space and time.

Enticing 'star architects' to design buildings on college campuses often faces universities with considerable debt and long-term operational and maintenance expenses. Most of these 'signature campus buildings' cripple universities with unwelcome deferred maintenance expenses that were uncommon with buildings built during the first half of the 20th century. Furthermore, once the architect leaves, the academic community is left to deal with the fallout of buildings that don't just ignore their surrounding contexts, but also frequently overlook basic construction principles.[8] As Phil Myrick writes: 'Billions of dollars go into building facilities that hide their assets behind blank walls. If a tiny part of the investment was directed to bringing the building program to the outside, it would make a vast difference on people's experience of the campus' (Walljasper 2008; Project for Public Spaces 2015).

Working with Arup Engineers, the university spent $15.8 million to retrofit the building—one third the original cost of the building—specifying that the goal was to preserve its original integrity (Levine 2021). Eventually, the rate of disrepair may exceed the cost and time dedicated to the maintenance of the overall building complicating its long-term value and, ultimately, its sustainability.

5.2 The Neue Staatsgalerie

The Neue Staatsgalerie, designed by British architects James Stirling and Michael Wilford in 1984, is conceived

[8] Notably, MIT sued Frank Gehry when his $300 million Stata Center made headlines not for its eye-catching deconstructivist design but for the 'pervasive leaks, cracks and drainage problems that have required costly repairs.'

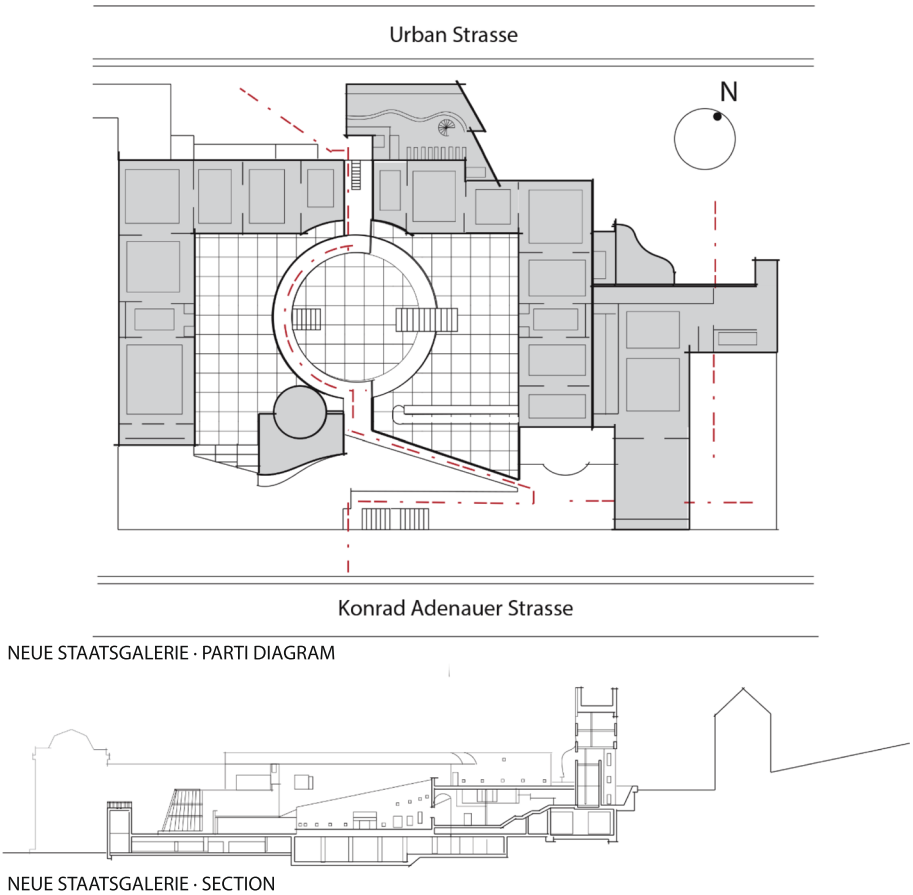


Fig. 6 Neue Staatsgalerie, Stuttgart, Germany, 1984. Above: Site plan. Below: building section (Source: the authors)

both as a ruin and as an 'inside-outside' building (Fig. 5). Repeated bombings of Stuttgart by Allied Forces during World War II had left the remnants of many buildings as burnt out shells. The consequences of the war and defeat left the German people physically scarred, economically weakened, and psychologically humiliated (Barkin and Sheehan 2021). Its cultural and psychic 'fragments' are expressed by the architectural fragments of the Neue Staatsgalerie.

The competition brief emphasised the urgency of restoring the spatial and historical continuity of the urban fabric by enhancing pedestrian movement. The program included three components: 1) an expansion of the Staatsgalerie, 2) a new theater building, and 3) a music school building. Contextualising the museum into Stuttgart's urban fabric and history was an imperative in the design so that 'the new building should contribute to the historical significance of the area by way of establishing relationships with other historical buildings' (Filler 1984). Stirling combined the traditional design elements of Classical 19th Century museums with modern, complimentary industrial materials that would ultimately invoke the timeless, yet ever-evolving essence of art and architecture (Kroll 2011). Each function is represented by different volumes organised on two levels that conform to the terrain of the site (Fig. 6) (Glusberg 1993).

The Neue Staatsgalerie is clad in horizontal bands of thin-cut stone veneer applied over a steel structure. Some critics compare the layout of the floor plan of the Neue Staatsgalerie to Karl Friedrich Schinkel's Altes Museum in Berlin with a centralised rotunda surrounded by galleries and services.[8] The 'rotunda' of the Neue Staatsgalerie forms an exterior courtyard wrapped by a spiraling ramp that leads the visitor through the site and into the museum. Sculptural building elements, glass-and-steel canopies, and undulating walls of glass gather light into the interior corridors and galleries.[9]

As the Staatsgallerie ages its continued historical and cultural value must be reassessed against the real costs of operation, maintenance and eventual restoration.

[9] According to members of the architectural team, the designers used their previous museum competition project for Düsseldorf, the Kunstsammlung NordrheinWestfalen, (Rodiek 1984; Stirling 1984), and the historical Temple of Fortuna as their starting point.

Stirling's early buildings included the History and Faculty Building at Cambridge, completed in 1968 where he and partner James Gowan struggled to study alternately freezing/overheating greenhouse, poor acoustics, frequent leaks and falling cladding tiles, which 'incubated a deep loathing of the building' (Saint 2011). In 1984 the pro-Stirling critic Reyner Banham wrote that 'anyone will know who keeps up with the English highbrow weeklies…the only approvable attitude to James Stirling is one of sustained execration and open or veiled accusations of incompetence' (Moore 2011). Fortunately, when Stirling began building in Germany, the building industry seemed better equipped to realise his ambitious ideas.

The composition of the Neue Staatsgalerie, while generally viewed favorably, distorts the traditional understanding of the building as complete, singular idea. Buildings of this genre become a 'bricolage' of recognisable figures: a kind of pastiche or blank, empty parody (Jameson 1983; Maulden 1986). It is a series of contextual integrations with the site as well as periods of art and design. Traditional building materials, such as travertine and sandstone, are combined with colored industrial steel throughout the museum that meld its postmodern expression with historical references.[10]

The material palette of polychrome thin-cut stone organised in horizontal striations, brightly painted steel mullions, canopies and funnels, and undulating walls of tinted glass produces a layered pastiche superimposed over a structural steel armature concealed within. While stone has historically been a load bearing material and highly regarded by preservationists for its natural beauty and durability, thin-cut stone is non-load bearing and is applied over rigid insulation supported by steel or aluminum studs. Lightweight coping stone capping the tops of walls with caulk sealants invites long term moisture and maintenance problems. The primary concerns with the veneer system included flaking of the stone veneer (delamination from the stone surface) falling off the building onto the ground below, some areas of large separations at mortar joints (reportedly increasing in size despite some efforts at previous repair), and progressive movement and deflection of stone veneer above openings (Ahuja, Verhulst, and Noble 2006).

Embedding the building in the sloping site increases the likelihood of moisture migration into the building through retaining walls and controlling humidity within the galleries. Remediating moisture problems in the future will require excavating around most of the building adding to its preservation costs. Humidity levels in museums and art galleries are notoriously difficult to maintain consistently. The constant influx of people through a room cause the temperature and humidity to fluctuate. Maintenance is also an issue as HVAC equipment will need to be maintained frequently due to the long operating hours. Anything that is costly to maintain will quickly become very expensive (Gates 2021).

Painted steel-and-glass canopies, skylights, exterior steel railings and ornamentation require regular maintenance. Skylights inevitably will leak due to failure of neoprene gaskets that get brittle as they age and will require replacement. Other details, such as openings created by 'missing' stone veneer blocks are likely to be avenues for water and ice problems as well as accumulation of detritus.

The undulating glass curtainwall of the Nueu Staatsgalerie will have to be replaced when its gas-filled thermal panes fail. Curtain walls are a form of exterior cladding that do not support floor or roof loads—they 'hang' off of the building structure like a curtain. These glazed systems form an integral part of the building enclosure; and as such, they must be designed and constructed to achieve various structural and nonstructural performance requirements, such as the following:

1. Water penetration resistance;
2. Air infiltration resistance;
3. Structural adequacy (transfer all loads back to building structure);
4. Energy efficiency;
5. Aesthetics;
6. Durability and maintainability.

Moisture problems are likely to occur when the flashing between the stone veneer and curtain wall do not connect or seal (McCowan and Kivela 2010).

Masonry System 7 (Fig. 7) is a rainscreen system with a steel-framed wall structure and adhered stone or masonry veneer suitable for many applications including low- or mid-rise residential, and commercial buildings, as well as buildings such as the Neue Staatsgalerie. The water control layer is a continuous control layer that is designed and installed to act as the innermost boundary against water intrusion and as an air barrier (National Masonry Systems Guide 2022). The adhered masonry veneer with grouted joints sheds most water it is exposed to; however, some moisture is expected to penetrate the cladding and enter the rainscreen cavity. This moisture is drained through the cavity by the continuous Z-girts that support the cladding or through the drainable, semi-rigid insulation. Masonry units are bonded to a crack isolation membrane over a cement backer board and non-metal

[10] Charles Jencks classifies the Neue Staatsgalerie as a high-tech building although it was designed late in Stirling's career. By this time, Stirling had shifted from functionalism and the industrial character of the University of Leicester Engineering Building of 1963 to a more ornamental pastiche of industrial materials.

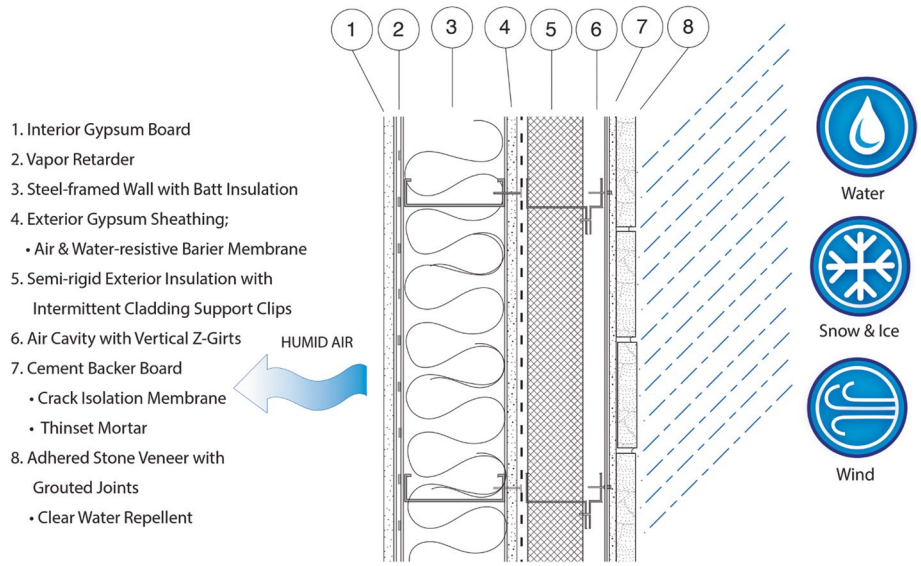


Fig. 7 Typical steel-framed rainscreen wall section with stone veneer cladding. Integrity of wall can be compromised by rain, snow and ice, and wind causing failure of cladding and moisture barrier systems and introducing humid air into interior rooms. Moisture and humidity control are critical for conservation of art objects. (Source: the authors)

or intermittent metal-based cladding support clips. The steel-framed backup wall will experience little volume change; however, some movement may occur where studs interface with floor and roof lines. As a result, both horizontal and vertical movement joints are needed to accommodate differential movement between the structure, cladding support system, and veneer components to prevent damage to the veneer or other components.

Advantages of stone cladding include its natural beauty, extreme durability and long lifespan, extensive range of stone types, complements other materials such as concrete and timber, offers a variety of finish options for. Wide range of applications, provides a high level of thermal mass contributing to reduced heating and cooling loads, and weather resistant especially when coated with moisture repellent sealers. Disadvantages include higher construction costs due to increased structural substrate, labor-intensive to install, expensive cladding material, and can trap moisture behind the material if poorly installed (Eco Outdoor 2021).

Even though most of ventilated claddings façades perform reasonably, some anomalies have appeared over the last few decades, such as deterioration of appearance, fracture, arching and falling of stone slabs, therefore causing durability and security problems (Sousa and Sousa 2019; Loughran 2006). According to inspections performed on several buildings with natural stone cladding façades, these problems seem more related to design and execution errors and environmental actions (Neto and de Brito 2012). One of the most uncommon anomalies is the bowing of marble slabs, which is characterised by a permanent large deflection accompanied strength decay of the slabs, causing them to fall from the façades (Loughran 2006; Akesson, Schouenborg, and Grelk 2006; Siegesmund, Ruedrich, and Koch 2008).

The Neue Staatsgalerie's postmodern pedigree is evident in the artful way that Stirling combined many styles and elements from historical museums into a modern piece of architecture that connects the public with its culture. In its fragmentation and apparent incompleteness, it can variously be perceived as a ruin or as a contemporary addition to an historical building within a dense urban fabric. The fact that it is a contextualised meta-narrative set within the urban fabric of Stuttgart, the cultural history of modern Germany, and its draw as a tourist attraction make it a likely candidate for preservation, but Stirling's arrogance predicating design over constructability and his checkered reputation for designing buildings that don't work bring even his most prestigious buildings into question.

5.3 Hedmark Museum

Daniel Willis points out that in pre-modern societies the goal was not geometric perfection, but to privilege meaning over utility and sustainability over efficiency (Willis 1999). Vernacular architecture, therefore, is inefficient because it combines pre-industrial production practices with the will to imbue its creations with an aura of significance. Critical Regionalism, which juxtaposes vernacular building forms and practices with modern technologies

Fig. 8 Hedmark Museum, Hamar, Norway, 1967–2005, Sverre Fehn architect. (Source: Columbia University Avery Library)

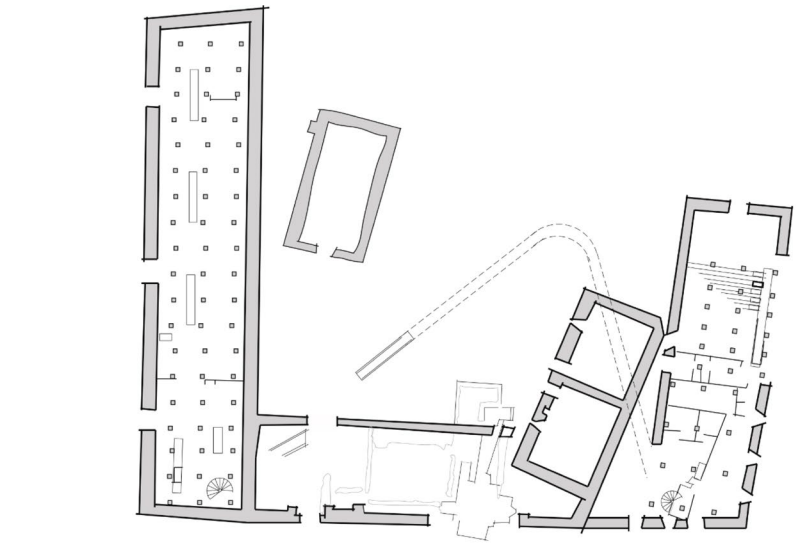
and materials, creates a new and provocative dialect that both affirms and critiques the historical interpretations and meanings of architecture from within by re-contextualising them in through the auspices of modernism (Tzonis and Lefaivre 1996; Frampton 1996).

The Hedmark Museum in Hamar, Norway (1967–2005), also known as the Storhamar Barn, is one of Sverre Fehn's best known works (Fig. 8). The main architectural objective was to create a museum from to preserve what remains of Hamar Bishopric and Storhamarlaven and make it possible for the excavation of the site to be an important feature. The answer for Fehn is the 'suspended museum' allowing he public to experience history brought alive through archeology (Norberg-Schulz 1979).

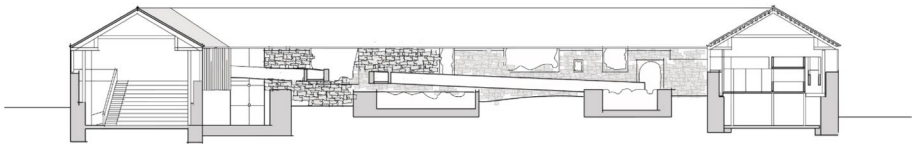
One of the elements that makes a place truly beautiful is a careful balance of complexity and simplicity. Contemporary architecture frequently just goes for the simplicity and forgets the complexity, or it makes up for the simplicity of its appearance with complexity in the technical processes necessary to build it. But the old buildings that please us most are frequently simple at the larger level and complex at the micro-level (Rennix and Robinson 2017). Created over a period spanning almost 40 years, the Hedmark Museum involves the recovery of the ruins of an ancient fortified house built by a local bishop of the 12th century. He deftly inserted the timber-frame and glass components of the new museum addition into the original building shell barely touching the remains of its constructive legacy. The original U-shaped building forms a central court shared with the foundations of primitive farm buildings (Fig. 9). An ethnographic museum occupies the original cowshed while the west wing houses Nordic cultural artifacts. Administrative services and an auditorium are also incorporated within the existing ruins creating an interesting dialogue between the history of the site and its modern additions.

A succession of ramps, stairways, and hallways allow the visitor to contemplate both the remains of the original building and the installed artifacts. A long, curved ramp lifts the visitor through the courtyard and into the building in a kind of journey into the past where artifacts recovered from the site have been carefully restored and placed on a collection of stands and pedestals reminiscent of the detailing of Italian architect Carlo Scarpa.

Fehn's objective was to preserve and protect the archeological integrity of the ruined buildings with interventions of new elements constructed of concrete, wood, steel, and glass to convey an 'intimate and poetic' message by means of a modern aesthetic (Fehn 1997). He contrasts the visual weight and rough textures of the original load-bearing stone walls with milled timber-frame posts and trusses that support a new roof structure punctured with sky lights (Fig. 10). Delicate steel pin connections supporting the massive timbers produce a visual



HAMAR MUSEUM · PARTI DIAGRAM



HAMAR MUSEUM · SECTION

Fig. 9 Hedmark Museum, Hamar, Norway, 1967–2005. Above: Plan. Below: building section (Source: the authors)

tension between the weight of the wood and the relative lightness of the steel, which is also echoed in the detailing of the stands and pedestals supporting artifacts. The interweaving of old and new elements reveals the characteristics of the rural culture of Norway, with special emphasis on ethnography, religion, and history through beautifully presented and illuminated objects (Fig. 9) (Barbam 2013).

Essentially, Hedmark is by-and-large an open-air museum, which means that the architect could focus on circulation, functional layout of galleries, preserving and protecting the existing archeological structures and the site, and designing the display of artifacts. Fehn had to address neither indoor comfort of inhabitants nor mechanical interior climate controls for the artifacts. Technical assessment of the museum, therefore, is based on his primary responsibility: preserving and protecting the archelogy of the site.

Fehn's material pallet is reduced to basic, durable materials: timber for structural framing; concrete for earthbound walls and circulation ramp and elevated walkways; and, steel for brackets connecting timber components, handrails, and pedestals and armatures for display of artifacts. These materials both complement and contrast with the existing stone archeological structures creating a potent interplay between the artifacts of the site and its modern interventions.

Natural materials such as stone and wood age well and develop patinas that enhance their inherent characteristics. Timber has been used in buildings for millennia and is a good choice structurally for its strength, durability, fire resistance, and weathering characteristics. It is also a renewable resource, which makes it sustainable. Timber frames can be the most suitable choice if the structural shell is required quickly, if the ground conditions are particularly poor, or if the design does not include very large structural spans (Designing Buildings 2021).

Traditionally, timber frames were connected using mortises and tenons joined by wood pegs. Water is the enemy of all buildings and especially of wood structures. Over time, they will rot if not properly maintained and the wood pegs in timber frame buildings will ultimate deteriorate causing connections to fail. While this method is still used by craftsmen, many modern timber frame buildings, such as the Hedmark Museum, are highbred structures that use steel brackets, gusset plates, and bolts to join together wood components.

Historic timber framed buildings used the heartwood from a variety of species of trees ranging from pines and firs to hardwoods such as oak. However, faster growing

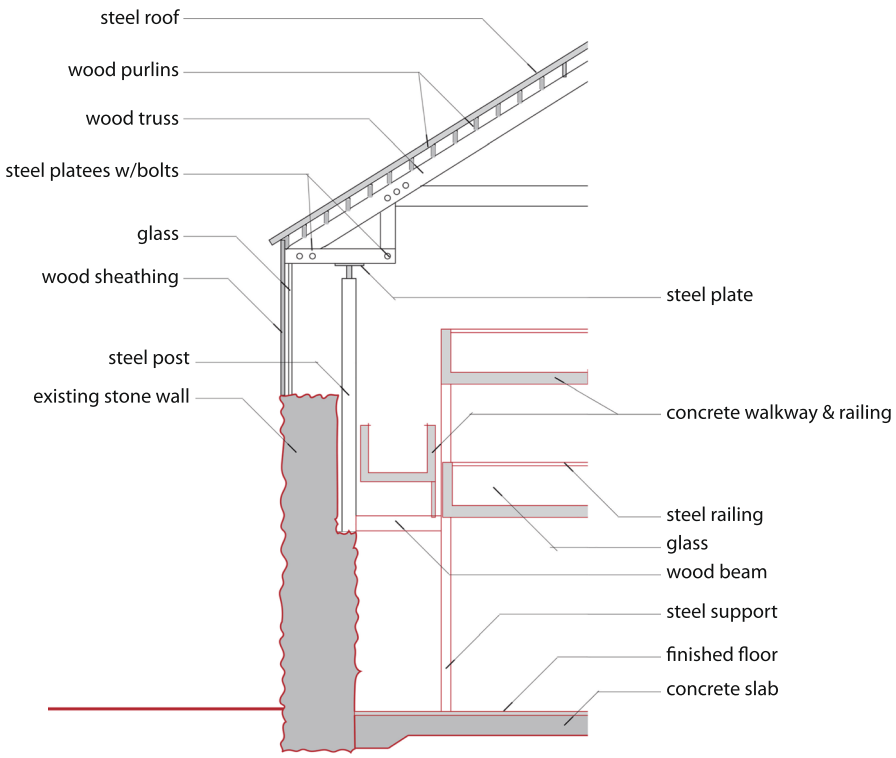


Fig. 10 Wall section detail of construction materials and connections of the Hedmark Museum (Source: the authors)

trees with less grain density are often harvested and used for timber construction today resulting in less structural integrity. Poor drying techniques can also lead to checking, twisting, warping, and other undesirable characteristics. Another option, is to use laminated posts, beams, and trusses. These can be produced by sandwiching together smaller pieces of wood together bonded with an adhesive. Laminated timbers are structurally stable, reuse waste materials, and are aesthetically pleasing when they are combined with modern materials and fabrication methods. Of course, wood must always be protected and routinely maintained when exposed to natural elements. At Hamar, the wood structure supports a sheltering roof that shields the structure, interior spaces and artifacts from the weather. In a sense, the Hedmark Museum is both on archeological exhibit and an act of preservation of both old and new elements.

Fehn created architecture which had a firm foundation in the Modern Movement, but was expressed in terms of the materials and language of their own region and time. 'When I build on a site in nature that is totally unspoiled,' he wrote, 'I strive to make a building that will make people more aware of the beauty of the setting, and when looking at the building in the setting, a hope for a new consciousness to see the beauty there, as well' (Michalarou 2021). His 'constructive thought' reunites the world and spatialises time through construction in a 'new synthesis endowed with an innate sense of origins and timeless principles' (Fjeld 1983; Norberg-Schulz 1979; Fehn 1997). Cook (1981) describes Hamar as 'a poised machine in its purest form hanging above the archaeology' and says that 'we are unused to a building that collages together devices, as in the tradition of the clockmaker, so that they seem naturally interdependent.'

The Hedmark Museum, therefore, is both an intervention of new architectural elements and preservation of the existing archeology of the original building remnants. In essence, the new architecture preserves and protects the old while forming an intricate dialogue between past and present, artifact and nature. Unlike the Wexner Centre and the Staatsgallerie, the Hedmark Museum is not a formalistic response to interpreting a site, but rather a poetic and practical and unpretentious adaptation of traditional material and craft-based sensibilities. This approach not only ensures the preservation

of the archeological site, but also the continued viability of the new building elements that are an authentic manifestation of craft and material cultural. With his poetic vision Fehn demonstrates that all architecture that strives to express the authentic must include an ethos of place and time.

6 Discussion

Regionalism and the renewed interest in vernacular architecture led to the demise of the artifices and stylisations of Postmodernism.[11] The shifting grids, acute angles, complex layering of materials and elements and the like that were seductive in models and drawings were not easy to achieve in the actual buildings. Like Eisenman, some architects preferred not to address these technical problems by affiliating with architectural/engineering firms for technical expertise. His nonchalance toward the needs of his clients, constructability and building costs was reflected in his early houses. For example, House VI took three years to be completed and cost twice as much as Eisenman had originally estimated. As owner Suzanne Frank wrote: '[Eisenman] was somewhat cynical about practical construction matters in general,' and 'Working drawings were lacking in specific detail…From the beginning, we had problems with leakage, and...by 1987 the house was in a frightful state' (Mehjabeen, Mirzaiedamabi, and Tang 2019).

Eschewing the abstraction of modernism and the hubris of postmodernism, Fehn turned to regional and vernacular architecture as inspiration for an organic and 'authentic' response to building. Adaptive re-use and preservation of existing buildings gives designers considerable latitude in juxtaposing the new with the old. Modern materials and technologies can be integrated with traditional craftsmanship, organic materials, and building methods to create a synthetic, poetic 'meta-language' that elicits new interpretations of form and meaning. This meta-language is neither a pastiche of signs and elements nor is it insular and self-reflective appreciated by an elite, educated audience. Rather, it is rooted in an indigenous culture where the necessity of dwelling is expressed honestly through nature.

Stirling based the Neue Staatsgalerie on historical museum models to organise its spaces and contextualise it with the city, as well as the tradition of museum design. Its evocation as a 'ruin' within the city of Stuttgart suggests a similar level of incompleteness achieved by Eisenman's Wexner Centre albeit with an entirely different architectural syntax. He creates a fragmented building that inverts the relationships of interior and exterior spaces translated sequentially along a continuous path linking the users' temporal experience of passage through art and space to the urban context of the city and German cultural history. Yet, Stirling also allowed formal design objectives to supersede basic construction techniques.

Conversely, in the museum at Hamar Fehn juxtaposed new architectural elements into the actual archeological ruins of the Bishopric structures to investigate the potential of 'an irrational idea supported by a rational structure' in which every material has its own poetic language (Fehn 1997). In this instance, the building program of preserving the archeology and artifacts of the site was ideal in providing Fehn with a palette of natural and sustainable materials integrated with an open-air museum that did not require a sophisticated heating and air conditioning system. His radical approach to restoration is best exemplified in his statement, 'only by manifesting the present, can you make the past speak.' He 'came of age in the shadow of Modernism;' but having to work primarily with an interior, and being able to consider the work a restoration project rather than as a definitive building seemingly freed him from the formal constraints and Modernist orthodoxies visible in his earlier work (Tandberg 2021). The overall impression is a building in an endless process of re-imagining, adaptation, and renewal that transcends its own time through which 'poetry and myth possess the ability of maintain contradictory opposites in a single image' (Willis 1999).

Figure 11 compares building systems and materials used in the three museums. As this paper has shown, the performance of buildings over their life-cycles is related to the quality of materials used, construction methods and details to resist the adverse effects of climate and environment, and the relative sophistication and complexity of technical equipment and services to maintain interior comfort and conserve artifacts on display.

Figure 12 illustrates how initial building construction and life-cycle maintenance costs increase over time for each case study museum. As building materials and environmental systems age, it is likely that they will have to be replaced not once but several times to maintain the functionality of the building. For buildings such as the Wexner Centre that has already incurred significant upgrade costs, replacement of the building may be the more cost-effective solution than renovation. By contrast, the Hedmark Museum demands far less to maintain and operate because it does not require complex environmental systems and uses a limited palette of proven organic materials that perform well over time.

[11] By the early 1990s and the influence of Deconstructivism, architects objectified architecture to critique it from within its discipline. While several Deconstructivist buildings were built and gained international attention, notably Daniel Libeskind's Jewish Museum in Berlin, many were plagued by the same technical and financial problems that had plagued the Wexner Center for the Arts.

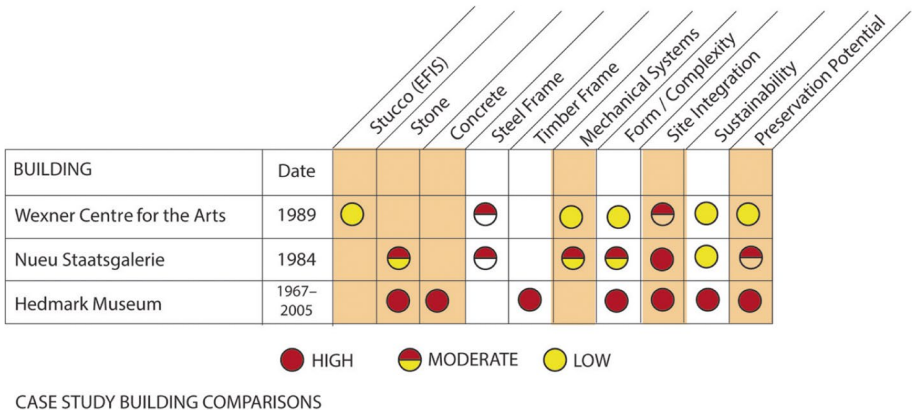


Fig. 11 compares each case study building in terms of materials, structure, mechanical systems, site integration, sustainability and potential for preservation (Source: the authors)

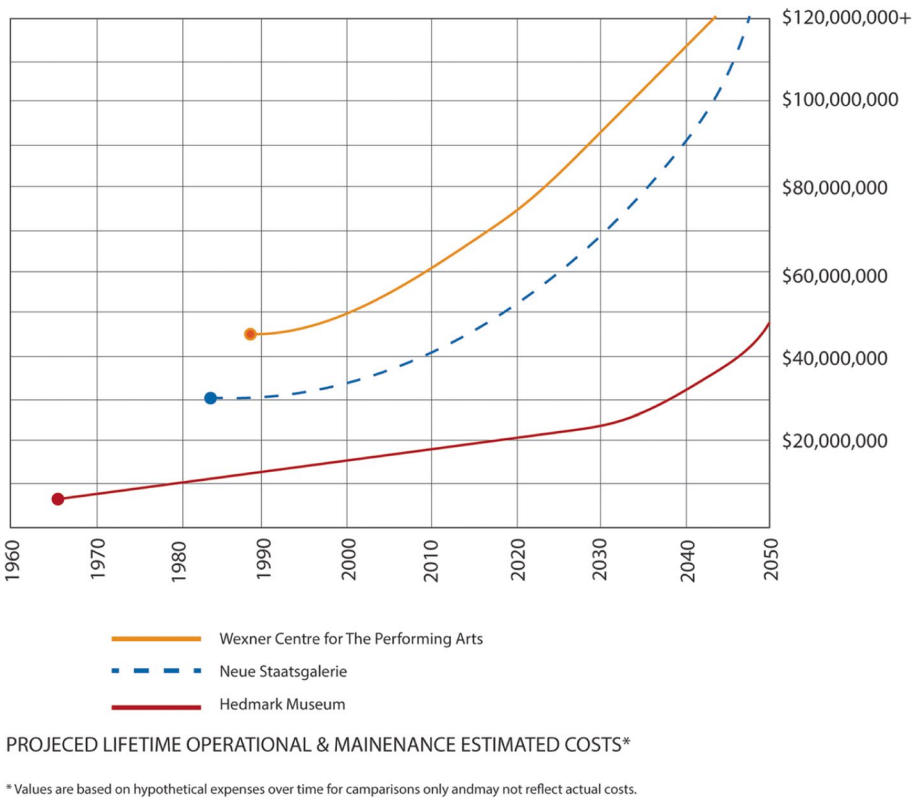


Fig. 12 Case study buildings comparisons of lifetime operational and maintenance costs. Note relative difference of simple building construction materials and methods and increased costs incurred with greater complexity. (Source: the authors)

7 Conclusion

When Postmodernism was in its heyday, Paul Rudolph recommended that architects return to the essential problems of design and building.

> *I would suggest that you pay close attention to what we regard as untutored people and how they approach their problems, how they approached them in the past, and how they still approach them. Of course, I mean vernacular architecture. I think that quite often people naturally do things when left to their devices, do things very well, and solve an awful lot of problems that architects tend to forget (Warfield 1985).*

The shift toward performance as a criterion for building design and sustainability was initiated from a technological platform by high-tech architects who were trying to reconcile the formalism of Modernism with the exigencies of climate and function. However, technology as a solution introduces attendant unforeseen problems. Sophisticated HVAC systems, active curtain walls, and electric lighting, regardless of their efficiencies, require copious amounts of energy to operate. The larger and more technical a building becomes the more difficult and expensive it is to maintain and operate. Architects, who wish to achieve more sustainable buildings, are well-advised to look at historical and vernacular buildings for inspiration and planning before they introduce new and often complicated building systems.

As architects critically re-evaluate the legacy of postmodern museum architecture, they are presented with clear choices about the direction of building and its impact on cultural identity and the physical environment as well as their long-term viability. If we are to create truly sustainable buildings that are timeless, we would do well to ground them in the values and lessons of climate, culture, and region. Preserving and adapting existing buildings to new uses must be part of the sustainability equation. This may include preserving and adapting only those postmodern buildings that have clearly transcended their own era and have achieved the status of cultural artifacts. At what cost and to what extent should these buildings be conserved is the question. Not all buildings should be preserved, especially when poorly constructed using inexpensive, unsustainable materials subject to environmental degradation and moisture problems. In many cases, it is the *idea*, captured in drawings and models, that may supersede the artifact. Preservation, therefore, does not mean replicating the past, but, rather, as George Santayana advises, to learn from it and avoid repeating its mistakes (Santayana 1998).

Abbreviations

HVAC	Heating, ventilation, and air conditioning
LCA	Life Cycle Assessment
EIFS	Exterior Insulation Finishing System

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