

Structural retrofitting in historic buildings – the case of Hearst Greek theatre, California

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Abstract

A modification process after manufacturing or constructing is called Retrofitting. Within the existing built forms it refers to the transitions made to the systems in the building or the structure after it is constructed or put to its defined use. Within the present day context, there are many historic buildings that are still in use or have the potential for future use. These may not be sometimes used to their full potential, despite their historic character and environmental features as most of them do not satisfy the contemporary needs of the present day user. They may also have been built for a purpose that no longer exists or has changed and often lag behind today's performance standards and codes. Therefore, for contemporary use of such historic buildings, Retrofitting for Rehabilitation is an opportunity for alterations and additions to suit it to the present day context. The most significant aspect of retrofitting is associated with structural refurbishment which aids for added strength, stability and safety of the historic buildings. Retrofitting measures in a historical building aims to improve the overall performance of the building, facilitate techniques to alter, repair or add to make the historic building fit for contemporary use without jeopardizing their historic qualities. Through case examples, the paper aims to bring out the trends in retrofitting and the retrofitting techniques that are being adopted in contributing to a sustainable future of historic buildings. The structural retrofitting techniques adopted at the Hearst Greek Theatre, California exemplify how historic buildings can be structurally rehabilitated to become a sustainable resource for future generations.

Keywords: Historic Building; Rehabilitation; Retrofitting; Sustainability

1. Introduction

Rehabilitation is a process of giving a compatible use of an existing property through the means of repairing the damages, appropriate alterations, and required additions yet preserving the characteristics features representing the various values associated with it. Rehabilitation is most commonly used level of intervention which allows for contemporary alterations and additions. Retrofitting¹ is a process that transforms an object after its manufacture or construction. Within the existing built forms it refers to the transitions made to the systems in the building or the structure after it is constructed or put to its defined use. The intention of retrofitting is improving on the existing facilities for its occupants and/or the overall performance of the building as a whole. Retrofitting for Rehabilitation is a process of makes changes within an existing historic building in order to adapt it for new uses satisfying the used needs without intervening with the property's historic integrity. (De Almeida, 2014 [1]). In recent years there has been increasing activity in "retrofit"-where new services and fittings have been installed to historic buildings. Retrofitting historic buildings are sometimes also seen as a risk mitigation measure against earthquake hazard impact on the historic structure as well.

¹ The word 'Retrofit' means to "to install or fit" with parts, devices, or equipments not in existence or available at the time of original construction. In Historic buildings it provides for installing a device or a system, for example air conditioning, disaster safety devices etc., for a use-in or on an existing structure.

2. Need for retrofitting in Historic Buildings

The basic aim of retrofitting a historical building is to improve the overall performance of the building adding to its long term usage and benefit. The retrofitting measures adopted for any historical structure may be adopted for one or more of the following:

2.1. Updating Building Systems Appropriately

It has become imperative to provide many contemporary Interior Systems, such as Heating Ventilation and Air Conditioning, plumbing, electrical and other technologies within the buildings that add to the user comfort and improve the life of the building fabric. Retrofitting helps to update the existing building systems in historic structures. It retains original significant historic features and thus accommodating new technologies and equipment. However, while updating the systems a conscious effort of minimizing the impact as far as possible should be made to retain much of the original building fabric and thereby maintain the building's integrity.

2.2. Improved Environmental Performance

The safeguarding and preserving processes adopted for heritage buildings contribute towards the sustainability. It aims to reduce the energy wasted during the process of demolishing, disposing the produced waste and followed on construction as well as conserve the embodied energy within the existing built fabric

contributing to a sustainability. Recently retrofitting has claimed to achieve optimum energy efficiency and improving the environmental performance of the building. While 40% of energy consumption is through buildings; retrofitting a historic building through appropriate energy efficient measures can reduce the adverse effect on the environment. An outstanding example is the energy retrofit in the Historical Empire State Building where various building measures were adopted as retrofit measures for improving environmental performance and reducing the CO₂ emissions.

2.3. Comply with Accessibility Requirements

Universal Access being an important concern in the modern day, therefore it becomes imperative to retrofit these historic properties more accessible to people with disabilities. It has become a mandate for designers to provide access for persons with disabilities while conserving our rich heritage. Adequate retrofitting measures allow historic buildings allow being accessible for people with disabilities. Alterations to historic properties to increase accessibility may vary from adding a small yet inexpensive ramp at the entrance besides the step or minor additions within the interior or exterior of the building to suit the needs of universal access.

For example in the Clotworthy/McMillan House, Heber City, Utah all additions were put on rear of house. The railings were added to front steps for support and an additional ramp was provided to rear entrance with appropriate modifications. Ramp being added on the secondary facade and does not intervene with historic the significance of the building. Such measures may not require major interventions however care should be taken such that they do not alter or affect the original historic character of the building.

2.4. Repair and maintenance of structural components

The most sensitive aspect of rehabilitation of historic buildings is related to their structural safety which counts for a complex building assessment. The strengthening of existing buildings can conflict with their cultural and historic. The seismic vibrations and other natural and man-made causes have adversely affected the historic building fabric with the passage of time. Thus Structural Retrofit gives way to transitions that may be required within a building to reduce any irregularities within the structure, strengthening and mass reduction of the structure along with base isolation for seismic safety. It thus aims to improve structural behaviour of the building in accordance to the building codes and also helps to preserve historic structure itself.

Associated with structural safety, these retrofit measures may also address the Life Safety and Security Needs, seismic, and security issues to preserve historic sites, spaces. Various retrofit schemes have been devised which aid to safeguard the historic buildings from the damages caused by natural disasters and by the various retrofitting interventions that may have been already adopted. Therefore, the type of structural intervention on the heritage building depends on an intensive condition assessment of the building, ranging from simple maintenance without damaging the cultural value of the building, to deep rehabilitation, when it can be retrofitted for disaster risk preparedness of the historic building for its future use.

3. Structural retrofitting

The structural retrofitting works in historic buildings can aim to repair and /or strengthen the building elements. Repair is done when the objective is to regain the load-bearing capacity of the building elements, while strengthening, increases the load bearing-capacity. Material differences of the past from that of the present also pose manifold challenges for the engineers. As against the use

of lime as binding material, surkhi, terracotta for facades and stones for structural components in the ancient construction, the use of cement based plaster, mortar and concrete and plaster in today's buildings the retrofit measures are invariably different.

The most common threat of structural retrofitting in a historic building is the damage caused by the proposed intervention to its appearance and integrity to comply with the norms given in the building codes. Since the most common ways to structurally retrofit is either to an additional structural members and to treat irregularities without any sensitivity to the architectural detail. Structural retrofit therefore becomes quite challenging as a sensitive approach in design and detailing is required regarding the historic character of the building, even if the retrofit components are visible. While structural retrofitting, three preservation principles should be considered as follows:

- Retain and preserve the Historic materials as much as possible and should not be compromised upon at all while adopting structural strengthening measures;
- In the retrofit systems, the integrity and authenticity of the historic building should be regarded and the intervention thus proposed should be visually compatible with it.
- As far as possible, interventions should be "reversible" for future use in terms of providing interior systems and repair of remaining historic materials.

4. Case study - the Hearst Greek Theatre, University of California, Berkley, California

The following case example of The Hearst Greek Theatre, University of California, shows the complete process of structural retrofitting of a Historical Building beginning from enlisting the significance of the Theatre, identifying the structural damages done to its Very Significant, Significant features and the retrofitting techniques thus adopted to preserve the "Values" attached to it. ("The Hearst Greek Theatre," 2007 [3])

The Hearst Greek Theatre is located in the north east of the University of California, Berkeley campus (fig.1) and was used as an amphitheatre within the University. Originally constructed in 1903 as a gift of William Randolph Hearst, the theatre received an addition designed in the Modern style by Ernest Born in 1957 (Born Addition). Initially isolated from the rest of the campus by a eucalyptus grove, the theatre now is circumscribed by student housing to the north, Bowles Hall to the southeast, and Gayley Road to the southwest. The site contains the original amphitheatre seating bowl and stage with its current use as an event venue and an addition at the rear of the stage, circulation, and landscaping which dates to 1957.



Fig.1: John Galen Howard's plan for the University of California. (Image courtesy of The Bancroft Library, University of California, Berkeley)

4.1. Historical Significance of the Theatre

The Hearst Greek Theatre has a high level of integrity and is per the National Register of Historic Places. It is an excellent example of a classical amphitheatre; as a site that represents the development of the Berkeley campus from the 19th Century period, the Hearst Competition and John Galen Howard, and the post-World War II era; and as a venue for important campus events and famous performances and figures from the larger culture. ("The Hearst Greek Theatre," 2007 [3]) The property is significant at the state level for its association with historically significant persons: Phoebe Apperson Hearst and William Randolph Hearst, because of Phoebe Hearst's role in planning the theater, her son's role in paying for the original construction, and his gift and the role of his heirs' business in the 1957 addition.

It is significant at the National level because it symbolizes the work of a master and acquire high artistic value. This theatre is one of John Galen Howard's first buildings on the Berkeley campus, and also one of the largest. More than any other one, it exhibits his use of classical precedent without programmatic influences of contemporary academic needs. The theatre is also significant under Criterion C because it fully articulates the ideal concept of a classical amphitheatre; this association is strengthened by its construction as a core building of the University when it consciously sought to become the Athens of the West.

The Born additions of 1957 are significant at the local because they illustrate how Modernist architects adapted contemporary forms, detailing, and use of materials to Beaux-Arts buildings. The landscape designed in consultation with Lawrence Halprin is also significant for the use of Modernist landscape principles in circulation and planting design. [4]

4.2. Historic Character defining Features of the Hearst Greek Theatre

The stage surface and the roof of the stage structure are Significant. (Fig. 2) .The other visible materials of the Howard design, including unfinished concrete with exposed aggregate and the concrete of the stage structure with a cement skim coating, are Very Significant.[5] (The amphitheatre has been repaired and exhibits significant deterioration in places, but retains its original form and the character of its original material and detailing so that it continues to convey the significance of its design and historical development.)

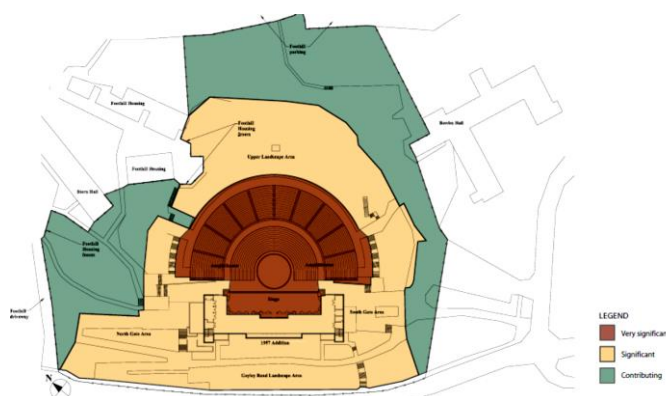


Fig. 2: Diagram showing historic significance of the Theatre and its surroundings (Image Source: [1] adapted by Author)

The prohedria of marble, granite, and cast stone are Very Significant. All works of art older than the Greek Theatre and archaeological objects incorporated in or fixed to the property are Very Significant. Very Significant (Primary Significance) are the Stage (all except stage floor and roof structure) and the Amphitheater seating bowl. While the Stage floor and roof structure (replaced as part of the 1950s repair program), the Born

Addition (all except toilet room fixtures and finishes), the Halprin landscaping, including the central court, planter boxes, north and south gate landscape areas and Gayley Road landscape area, upper lawn seating area, and inner circumference of upper landscape area are Significant (Secondary Significance). The Contributing (C) features are Born Addition toilet room plumbing fixtures, floor and ceiling finishes, and partitions along with the periphery of the site. All remaining features like the Asphalt Paving, Fences, Lighting Fixtures etc., are Non-Contributing (NC).

4.3. Structural Assessment of the Very Significant Components

Since the stage and its colonnade and the Auditorium seating bowl were very significant elements so their structural assessment was important to prevent any damage that could be caused due to any unforeseen event.

4.3.1. Assessments of hazards relating to the colonnade

4.3.1.1. Global Collapse of Colonnade:

The greatest hazard presented by the existing structure is the overturning or falling of large volumes of concrete. In addition to its presumed lack of steel reinforcement, the colonnade is also divided into segments by "cold joints" or separations between concrete pours, many of which have cracked through the cement plaster coating. Architect Walter Steilberg's 1954 crack survey drawings (Fig. 3) suggest a horizontal joint between column capitals and architrave as well as vertical through-wall cracks within the architrave. Calculations predict that even lower levels of acceleration could cause overturning about the base, crushing of concrete at the base, or soil bearing failure beneath a single column. In reality, these failure modes are restrained by adjacent panels spanning to the perpendicular end walls and to the thicker central portion. While the colonnade's C-shaped plan does provide some inherent strength that has prevented collapse in previous earthquakes, yet it needed a treatment due to the sudden, non-ductile failure of unreinforced concrete.

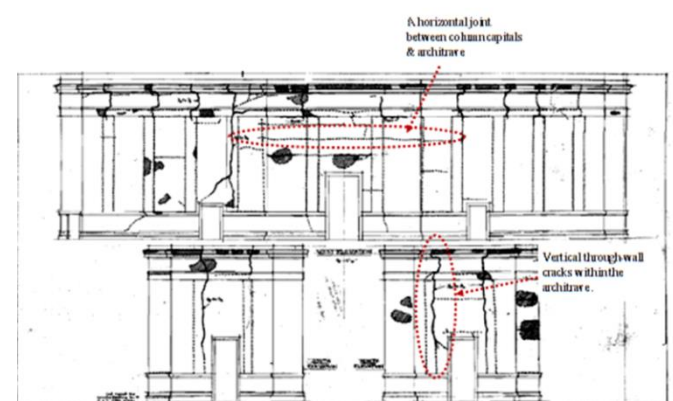


Fig. 3: Crack survey drawing (Image Source: Tipping Mar structural engineering firm adapted by Author)

4.3.1.2. Local Collapse of Panels

Another set of critical cold joints were those between columns and wall panels. Concrete core sampling of one column in 1992 showed that a portion of wall was cast integrally with the column, with keyways formed to accept adjacent wall panels cast later (Fig. 4). Regardless of whether the sheet metal lining the keyways represents formwork left in place after the column pour or whether it was added prior to the wall pour, the result is a possibility for movement between column and wall. The unreinforced concrete wall panels are likely to break up and/or fall during an earthquake unless they are reinforced and tied to the columns.

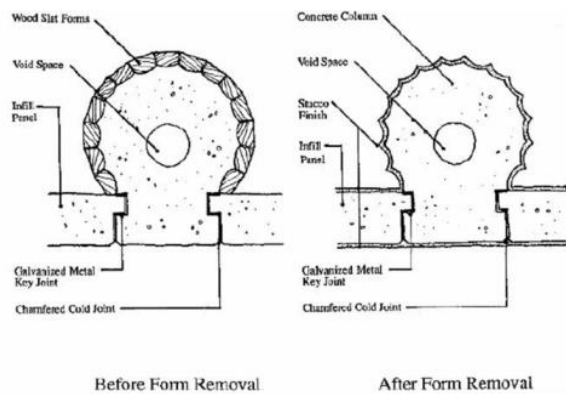


Fig. 4: Plan details of joints between columns and infill panels

4.3.1.3. Detachment of Cornices

Cornices at the architrave level and above the central west doorway presented a significant falling hazard due to their weight and projection from the structure. Seismic acceleration and/or displacement of the structure may impose forces great enough to detach these components, especially in locations with existing cracks. These components are assumed to lack steel reinforcement. (Fig. 5)

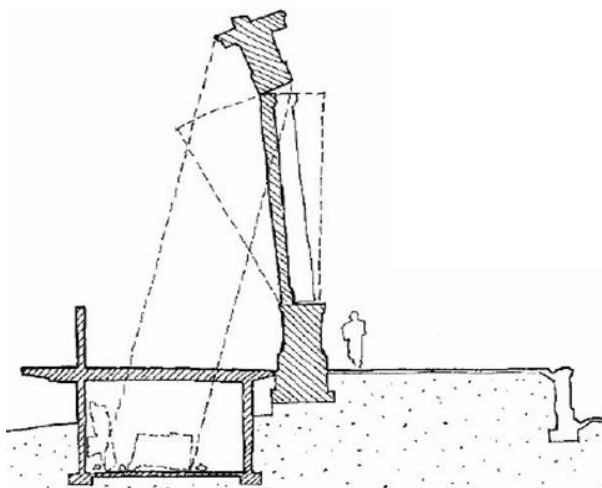


Fig. 5: Weak joints at the colonnade with the architrave may lead to a collapse as shown in the section.

4.3.2. Assessments of hazards relating to the Seating Bowl

The auditorium's seating bowl is constructed partly on an excavated slope, and partly on backfill retained by unreinforced concrete gravity walls. Previous studies have noted that the walls lack adequate factors of safety against overturning and bending failure; chronic settlement and cracking may have been exacerbated by the alterations completed in 1957.

4.3.3. Assessments of hazards relating to the Backstage 1957 Addition:

Since the backstage addition and auditorium toilets were completed in 1957, the construction conforms to concrete detailing of its era." The hazard posed by pre-modern concrete detailing in the backstage addition and auditorium toilets, were assumed to be relatively minor when compared to the unreinforced concrete colonnade. The existing fire protection piping and equipment lacked the seismic bracing required for non-structural components by current building code. In addition to the primary hazard of pipes breaking and falling on occupants, there is

a secondary hazard from the system losing pressure and failing to extinguish a fire.

4.4. Objectives of Retrofitting in the Theatre

Since the project called for a strategy of retaining and preserving the most significant character-defining features of the buildings (fig. 6) and for the Hearst Greek Theatre seismic updates, the Standards for Rehabilitation were considered to be the most appropriate treatment for the project.[6] Due to poor-quality concrete and lack of reinforcement, the stage colonnade presented a very real, urgent life safety hazard. A major seismic event could cause the global collapse of the colonnade onto the stage and through the stage floor into the Born Addition. Additionally, the wall panels between the columns have the potential to collapse onto the stage during a major seismic event, and the cornices at the architrave level could potentially fall onto the stage. As the colonnade would have presented the most significant potential for loss of life in case of a major seismic event, retrofitting was the primary purpose of this rehabilitation project. As a qualified existing historic building, Greek Theatre was reviewed for building rehabilitation as relates to the stage structure, as well areas immediately adjacent to it, such as the Born Addition, including the dressing rooms in the wings and the central subterranean level. The rehabilitation measures were framed for providing life safety upgrades as prescribed by the State Historical Building Code.

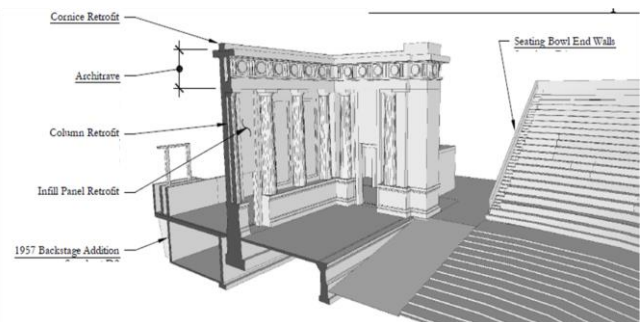


Fig.6: Proposed Retrofit components (Image Source: [1] adapted by Author)

Accessibility upgrades for the Greek Theatre as per the federal and state codes and regulations, as well as University of California policy were another aspect that made its rehabilitation process significant. The building was made to meet American Disability Act requirements as modified by state standards and conformance as a Public Accommodation Facility. The intention was to preserve the integrity of the qualified historic building while providing access to and use by persons with disabilities.

4.5. Retrofit Schemes

Two seismic retrofit schemes (fig. 4) were developed for the stage colonnade: an exposed retrofit scheme and a concealed retrofit scheme. Both schemes acknowledge the urgent need to seismically brace the colonnade, stabilize other components of the amphitheatre stage and seating bowl, and minimize impact on historic fabric to the greatest extent possible. [5] Other factors that were considered include reversibility and permanence.

The impact of the seismic retrofit on the historic fabric of the Greek Theatre was the primary consideration. Both schemes presented aim to minimize impact, though in distinctly different ways. The exposed retrofit does not impact the interior of the building envelope, instead constructing a system of steel walers, struts, and frames attached to the rear stage wall. The concealed retrofit is designed to have the least impact possible on the visual

historic fabric, or the exterior of the stage. It relies on bracing within the existing building envelope.

4.5.1. Exposed Retrofit Concept

This concept seeks to reduce the risk associated with design assumptions by placing reinforcement on the exterior of the colonnade. (fig.7). While this approach has fewer performance limitations and is more reversible than concealed reinforcement, it has a greater impact on visual appearance, architectural program, and envelope. Both the original colonnade and the 1957 backstage addition will be affected. This concept proposed new drilled concrete pier foundations outside the west wall of the 1957 addition, possibly requiring tree protection and other measures to mitigate damage to this historic landscape area. Holes were to be drilled into the existing colonnade for epoxy-anchored dowels connecting to the new steel bracing. The solution was made less visually obtrusive by concentrating struts at four locations and by the use a network of horizontal and vertical walers to distribute loads between them. The horizontal walers perform the additional functions of bracing the infill panels and holding the vertical walers away from decorative trim elements. Constructability issues related to this concept include working in close proximity to historic fabric, particularly where foundation drilling and steel erection must take place in or over the historic landscape area west of the backstage addition. Risks inherent in design assumptions include the variability of concrete strength in the colonnade and unknown subsurface conditions below the addition. The external retrofit concept is intended to mitigate the hazard of global collapse but should be paired with panel and cornice retrofit work in order to address these lesser but still significant hazards.

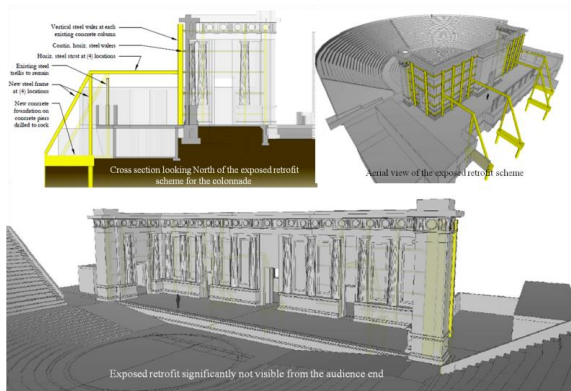


Fig.7: Exposed Retrofit Concept

4.5.2. Concealed Retrofit Concept

This concept minimizes visual, program, and envelope impacts by working within the existing structure, but the trade-offs are substantial risk associated with design assumptions, a lack of reversibility, and an upper limit on performance imposed by the existing geometry (fig. 8).

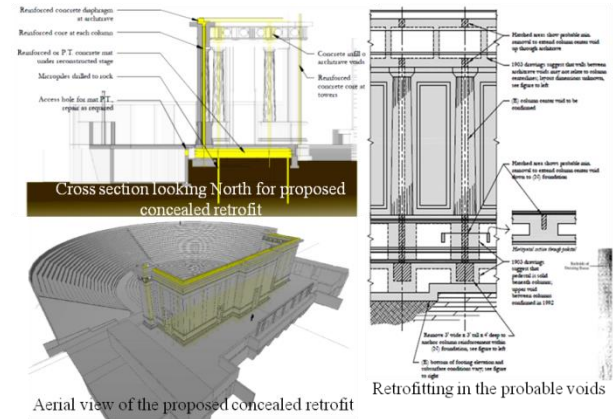


Fig.8: Concealed Retrofit Concept

To mitigate the risk of soil bearing failure and global overturning, this concept involves removing and replacing the existing stage in order to construct a new micropile-supported concrete mat filling the entire rectangle between existing colonnade walls and stage apron. Some underpinning of, and core drilling through, existing foundation walls were required to make a connection to the new mat foundation.[7] The existing colonnade roof must also be removed and replaced in order to construct a reinforced concrete tie beam above the cornice; this will be in place of an existing unreinforced concrete “spine” and its profile will be designed to minimize visibility from the audience. Existing column center voids must be extended upward into the architrave and downward into footings in order to install new vertical reinforcement. The concealed column reinforcement concept is intended to mitigate the hazard of global collapse but should be paired with panel and cornice retrofit work in order to address these lesser but still significant hazards.

4.5.3. Comparing the two retrofit schemes

Criterion	Exposed Concept	Retrofit	Concealed Concept	Retrofit
Reversibility	Mostly reversible		Not reversible	
Visual impact	Highly visible from sides and rear of colonnade		Minor visual impact due to reinforced spine profile	
Impact on historic landscape areas	Significant impact		Minimal impact	
Design risk due to unknown layout & condition of voids	Minimal risk		Critical to column retrofit	
Design risk due to variations in concrete strength	Affects design of anchors from new steel into existing concrete		Critical to column retrofit	
Design risk due to variations in subsurface conditions	Affects design of new foundations west of backstage addition		Affects volume of rock to be removed for new mat foundation beneath stage	
Expected damage state after major seismic event	New steel yielded and needing replacement; existing concrete may or may not be salvageable		Reinforcement yielded and inaccessible for inspection; entire structure may need replacement	

5. Analysis

The two retrofit schemes comply with the standards of rehabilitation as detailed below:

S. no.	Exposed Retrofit scheme	Concealed Retrofit scheme
1.	The Hearst Greek Theatre was designed for assembly and entertainment use. The exposed retrofit retains this use. The horizontal steel struts are elevated 19'4" feet above the central court.	The exposed retrofit concepts retain the original use that it was designed for assembly and entertainment. The seismic bracing is placed within the existing stage walls and end pylons, under the stage floor, and atop the roof. The building use is not affected.
2.	The exposed retrofit scheme impact the historic character of the Hearst Greek Theatre, but the impacts are restricted to secondary facades and features that can be temporarily removed and later restored	The concealed retrofit adds new structural elements within the existing building envelope. It does not alter the stage except the stage floor and the roof spine (Significant). Because the stage floor and roof covering were both altered in the 1950s repair program, the concealed retrofit does not impact original historic fabric. The overall historic character is well retained and preserved with very little visual evidence of the concealed retrofit scheme.
3.	The exposed retrofit does not include elements that create a false sense of history or add conjectural features. The design of the retrofit structure does not attempt to mimic the design of the 1903 stage or the 1957 Born Addition. All new elements are further differentiated as new construction by modern materials such as steel, modern construction methods	The concealed retrofit does not include elements that create a false sense of history or add conjectural features. The only visible alterations occur with the removal and reconstruction of the stage floor and the roof spine. Both features are reconstructed as close to their current finishes, dimensions, and placement as possible. The stage represents a record of its time.
4.	The Born Addition has gained significance in its own right, as recognized by the <i>Historic Structure Report</i> and the National Register designation. The exposed retrofit does not impact the Born Addition, but the four new 4' wide x 22' long grade beam foundations is placed in the Gayley Road area of the Halprin landscape.	The Born Addition has gained significance in its own right, as recognized by the <i>Historic Structure Report</i> and the entire property's National Register listing. A small portion of the east interior wall of the subterranean level is removed for crawlspace access and replaced at the conclusion of work. Otherwise, the concealed retrofit retains all historic fabric in the Born Addition.
5.	The exposed retrofit scheme preserves the unique techniques, features, finishes and materials and exceptional craftsmanship that sets apart the Hearst Greek Theatre. Changes to the material and finishes of the rear stage wall and Gayley Road landscape area is limited to attachment of fhorizontal steel walers on the rear wall and construction of four 4' wide x 22' long grade beam foundations in the landscape area	The concealed retrofit involves removal and reconstruction of the stage floor and roof spine, which were replaced as part of the 1950s repair program. These two features are identified as Significant features in the <i>Historic Structure Report</i> . The removal and reconstruction of these features does not adversely impact the historic building or landscape.
6.	The exposed retrofit does not include replacement of the deteriorated colonnade. Instead, it braces the rear (west) stage wall with a frame of vertical and horizontal steel walers. The rear wall remains intact. The pedestal, belt course, and projecting central entrance also remain intact.	The concealed retrofit includes a new mat foundation with micropiles, extensive bracing inside the columns, and the reconstructed roof spine. The only distinctive features that are visibly affected under the concealed retrofit are the stage floor and the roof spine. The new stage floor matches the old in design, colour, texture, and
7.	No chemical or physical treatments are proposed for the Greek Theatre. If these treatments are later deemed to be necessary, care will be taken that the treatments damaging the historic materials will not be used. Any future treatments shall be evaluated by a qualified historic preservation architect or an architectural conservator.	materials. The roof spine is reconstructed as close to its current finishes, dimensions, and placement as possible.
8.	The retrofit scheme requires excavation for the insertion of concrete piers and a new grade beam foundation during which if any archaeological material is encountered construction will be halted and a proper analysis will be undertaken by qualified specialists.	The retrofit scheme includes minimal excavation for the insertion of micropiles. If any archeological material is encountered during this work, construction will be halted and a proper analysis will be undertaken by qualified specialists.
9.	Although the exposed retrofit scheme impacts the historic character of the Hearst Greek Theatre, the impacts are restricted to secondary facades and features that can be temporarily removed and later restored.	The concealed retrofit does not include any additions or major exterior alterations that will destroy the overall stage. New construction impacts the stage floor and roof spine, which were replaced as part of the 1950s repair program. The removal of the stage floor and roof spine does not adversely affect the building, since these elements are reconstructed and any alterations do not impact the historic character of the building. Since the materials used in reconstruction are compatible with the historic materials of the building, therefore the concealed retrofit duly maintains the integrity of the building and landscape.
10.	The exposed retrofit scheme is reversible. The removable of this retrofit will not impair the integrity and essential form of the historic buildings as well as the character defining landscape	The concealed retrofit does not include any new additions or related construction on the site. For the most part, the concealed retrofit consists of structural reinforcements added within the existing building envelope. The retrofit is not reversible, due to the insertion of micropiles, construction of a new foundation, and extensive work inside the existing building envelope. However, seismic upgrades are rarely reversed, and this upgrade is anticipated to extend the life of the building and provide for public safety while retaining the significant historic features of the building.

6. Conclusion

The most sustainable building is the one that exists- and therefore conservation of such historic buildings that have a potential for future use aims at the long term survival of our heritage for the enjoyment of our own and the coming generations. Retrofitting for Rehabilitation is thus a process which prolongs the life of cultural heritage for its present and future use. Appropriate refurbishment

through a well identified and rightly documented intervention prevents the damage of a building without damaging or falsifying its historical evidences and values. Thus conservation through retrofitting processes can be rightly termed as A Future For Our Valuable & Indispensable Past.

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