LIGHTING IMPACT ON ARCHITECTURAL MODIFACTION OF AN ADAPTIVE REUSE BUILDING: A CASE STUDY OF TATE MODERN GALLERY IN THE SOUNTHBANK OF LONDON

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ABSTRACT

This research explores the analysis method of the current situation in Tate Modern, an adaptive reuse gallery that injects architectural intervention in terms of its massive modification from an industrial powerhouse station building to a gallery. Thus, exploration of lighting fundamentally and significantly impacts holistic and stage performance in the gallery design. However, there was a still few research that focused on the condition in lighting design performance for an adaptive reuse building of an industrial building to gallery. Therefore, this study explores design recommendations study made in the current state of the Tate Modern gallery as a methodology which includes passive and active design implications used recorded as part of the discussion. The result shows that the proposed design helped in lighting enhancement of the Tate Modern compound towards the Southbank area of London and how it injects end users' livability through its architectural modification through implementation of the skylight, upwards lighting, designated window, and sunbreak for the best rectification recommendation. Furthermore, the result of the study suggests such minimum glare and effective lighting distribution contribute to the amount reduction of energy consumption, improve the quality of reading, performance and properly enlighten the gallery activities and other exercises carried out to optimum brightness from its previous state as a powerhouse station.

Keywords: *sustainable, adaptive reuse, building, heritage, lighting*

INTRODUCTION

One of the great examples that practiced this principle is Tate modern gallery, which world widely known for its brilliant effort in representing the element of industrial essence of the old power station. Tate modern took the strategy of repositioning the entrance with ramp to

celebrate people extensively into the building through the lobby of turbine hall as per Figure 1. It had positioned a gigantic incline ramp delicately and ceremoniously into the turbine lobby as per Figure 2(left) which unequivocally suggests to the thought that when individuals enter the gallery nothing ought to lower and higher in states. This makes all the end users who are in the north and south entrance have the same sort of identical entrance concern as per Figure 2(right) below. This old power station uses different brilliant methods in order to lure people in perceiving the character and ambience engulfing the old building. It is like promoting them standing in front of the threshold from the era of industrial in the South bank to the heritage era in the North bank on the other side of the river (Hanapi et al., 2022)

Figure 1: During the construction of the ramp in turbine hall of the old powerhouse station

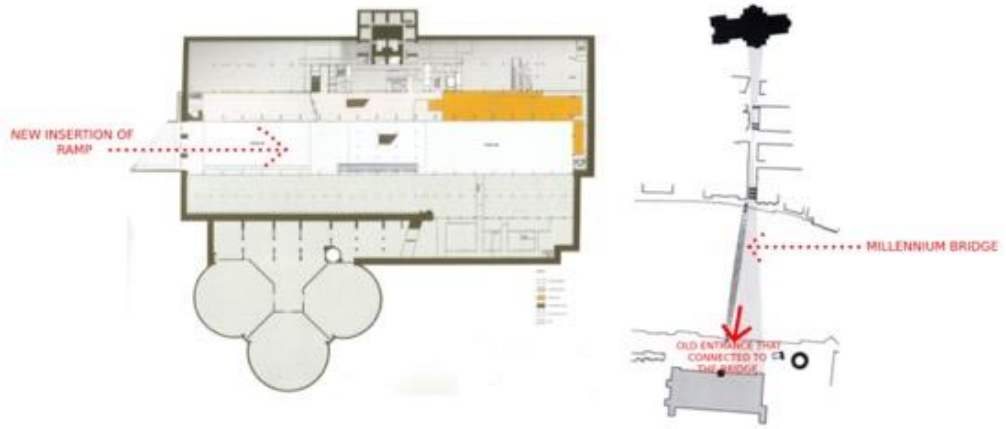

Figure 2: Left) Ground plan of Tate modern showing the new ramp insertion in the middle. Right) the Level 1 plan connected to the bridge that implies the axis that protruding into existing entrance strengthening connection between North and South bank of London

Figure 3: The millennium bridge completed in 2000 and reopened in 2002 after the wobbly occurrence

ISSUE AND PROBLEM STATEMENT

The research is being carried out to investigate comparative studies on lighting effect on architectural, displays artefacts and human scale on adaptive reuse building from industrial typology influence onto new art gallery. Even though most countries have come a long way since their colonial period, there still have an exceptional number of research studies of industrial structures and their lighting effects that can be reused and remained until today regardless of function or typology. Industrial influence does play a significant role in affecting architectural expressionism towards modernity development in architecture (Petković-Grozdanovića et al., 2016). Hence, Tate Modern, London with its compound study area is selected to understand the lighting impact modification made to the total repercussion to the artefacts, end-users and surrounding context of the city and the Southbank itself as per Figure 4 below.

Figure 4: The connection of Millenium bridge at the Tate Modern entrance that illustrates the existence of axis in those two eras and the south and north bank of the London

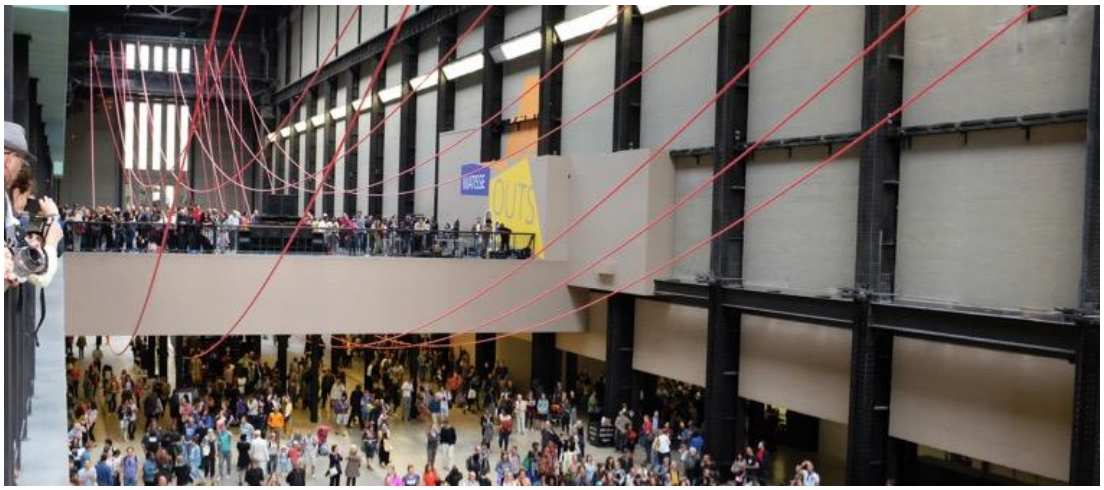

Figure 5: Scale of artefacts, displays items and human entourage are essential in defining comfort visiting experience

LITERATURE REVIEW

I. Architecture Conversion

The iconic Tate Modern on the Southbank in London underwent transformation to refurbish areas of the Bankside power station building previously. Having the ramp does contribute to the idea of social-culture cohesion in the building as shown in Figure 6. Inculcating the architecture conversion, the ramp in the old turbine hall is not just representing as the new entrance. Having it, like a method of dealing with the topography of the landform in the site together that aiding the visitors to access all the four entrances. It is in fact, denotes to a scheme in order not to treat the Tate modern solely as the shell or closed cubical. This shows that the construction of the transitioning entrances, including the ramp between the East and the West entrances acknowledging the topography of the area (Evans, 2005). Having studied-on repositioning of the entrance back, it is undeniable that entrances are the most important thing that gives a big impression to the how the building may be accepted and welcomed to the people (Dallard, 2001). This in a way implies some sort of grandeur impression on the people so that they feel more delighted and have such a warm invitation to the building. This gives power of first impressions and grants such impact to the new adaptive reuse building gallery design (Crisman, 2007).

Figure 6: The Tate Modern section drawing showing the ramp (old turbine hall) insertion on the western entrance

II. Fusion The History And Industry Concept

Building or structure of the old industrials speak to the identity resemblance and character of a spot and stay for a major portrayal of the culture and what sort of economic generated based from the specific site in Figure 7. From the contemplation of Herzog & de Meuron’s transformation, there could be vast noteworthy significances of these social venues pick an old industrial building as a mean to build a new structure? The well fusion the history and industry concept had been delivered outstandingly by the how the Tate modern inculcating and adopted the building facing towards the old Christopher Wren's of St Paul’s Cathedral that produced a notion of architecture in which one cannot distinguish between concept of the old and the new. (Amalina Hanapi et al., 2022)

METHODOLOGY

To complete the review study, the method involved is observation at the site, literature review study and interviews with the end-users. Based on all information and graphical evidence collected, lighting conditions impact was recorded to substantiate the design modification done from the old powerhouse station. The collected data is a secondary type of data, and the conducted study is qualitative research as per Table 1.

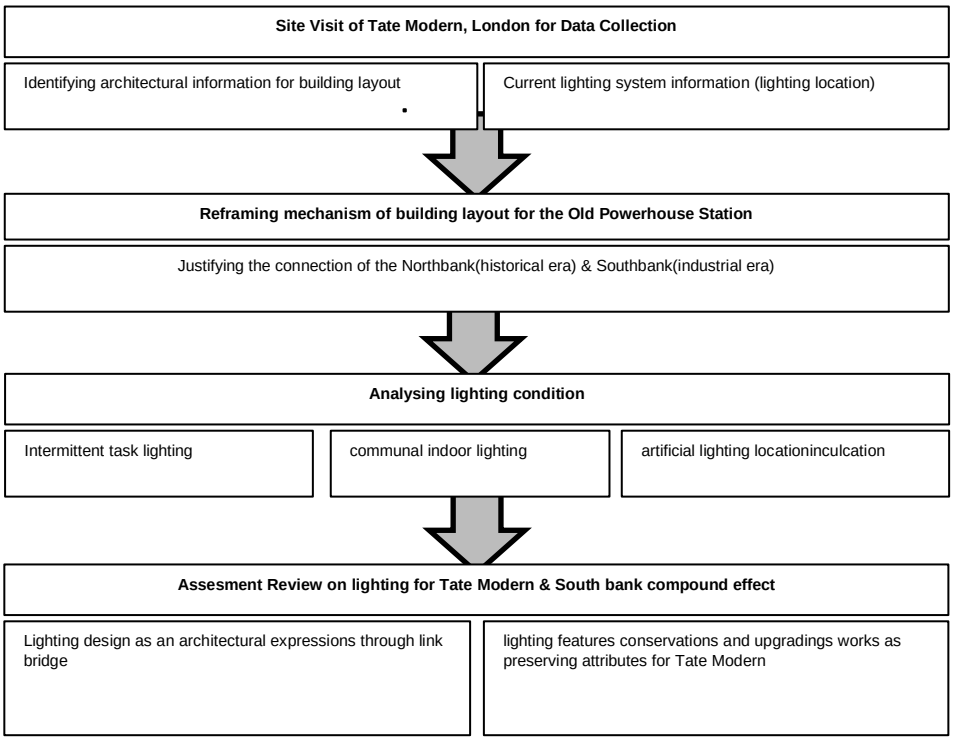

Table 1: The method for lighting study for the adaptive reuse of Tate Modern gallery

RESEARCH SCOPE

Concerning the idea of adaptive reuse on the cultural and heritage part is the main highlight the research topic that would also render transitional eras as a journey to go through this intention. The research topic is developed of series of understandings on the former research papers, article and books that would help combining fathomable knowledge related to virtual and physical impact in this building concept on revitalization of Tate Modern.

DISCUSSION

Based on the visual assessment of the interior and exterior part of the gallery, the new architectural modification suggested better lighting conditions performance, efficiency and control the needs of the tasks to be carried out (Sanchez & Haas, 2018) The study discussed the communal spaces in the turbine hall with the new ramp insertion as the prominent highlight of the findings.

SKYLIGHT FOR PROMINENT AREA

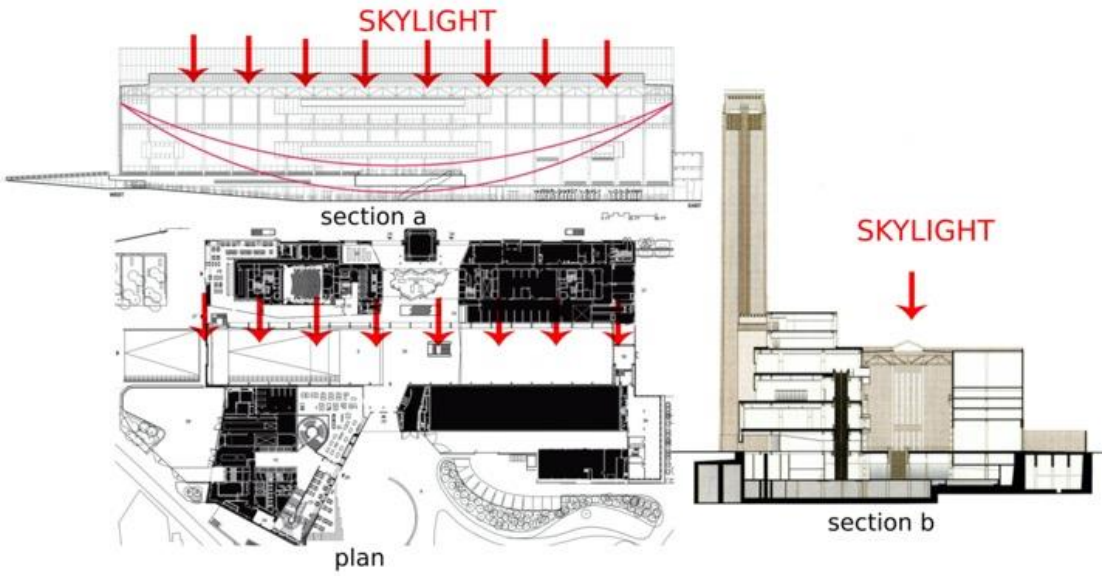

Figure 7: The Tate modern skylight assessment

A full daylight gallery is appropriate, but the design must provide great allocation of the control daylight amount on certain usage or display in gallery in terms of attention given to the communal spaces and showcase area for the artefacts. One of the most common ways to propose daylighting is through implementation of skylight. (Hanapi & Rodzi, 2022). Conservation of adaptive reuse buildings whether reconstructed, restored, rehabilitation, or preservation has changed some of features such as courtyards, clerestories and lantern skylights and hence reducing daylight performance which has always been a major privilege in sustainable design. In Tate modern the treatment of clerestories, and roof openings have managed to produce a significant and inspirational human comfort zone and even give a way finding for the building at night as shown in Figure 8 and 9. The floor materials; roofs with openings; walls with windows; and clerestories were designed with care.

Figure 8: The Tate modern luminous roof which is like a beacon of light at night

Figure 9: The corridor of Peters Hill that delivers the South-North route axis

MAINTAINING SUNBREAK

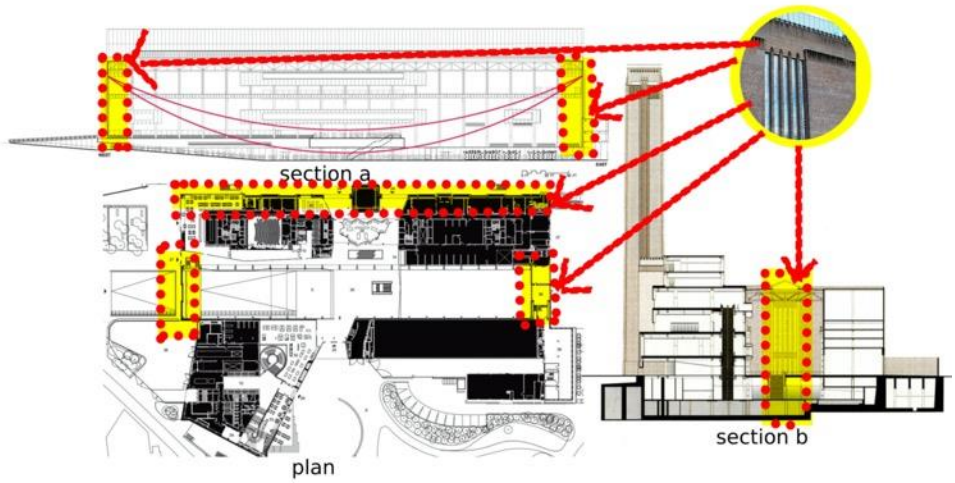

Figure 10: The existing sunbreak of Tate modern which is being maintained until today

If one building is properly designed to ease daylight, they reject most of the direct sunlight but still admit ample supply useful ones and there are many ways to control the sun's radiant heat and one of them is through the sunbreaks which designed in various ways to capture the only wanted sunrays. As for the gallery, having sunbreaks around the communal area would be the best way to overcome the hot scorching suns. The fixed vertical sunbreak used for Tate Modern comprises projecting piers, vertical fins or blades, vertical louvers and other fixed vertical architectural features used to shade windows from sunlight used in Tate Modern (Kruisselbrink et al., 2020). Partial control of sunlight penetration can be obtained by using this method. However, the contrast between the sunlit and shaded area is not sufficiently reduced, which would be suitable depending on the type of outdoor exhibition carried out.

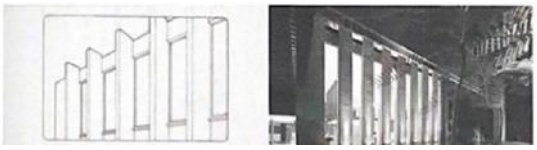

Figure 11: Vertical sunbreak comprises projecting piers, vertical fins or blades

Figure 12: The turbine hall which now becomes livable space for meeting point

ENHANCING UPWARD DIFFUSING

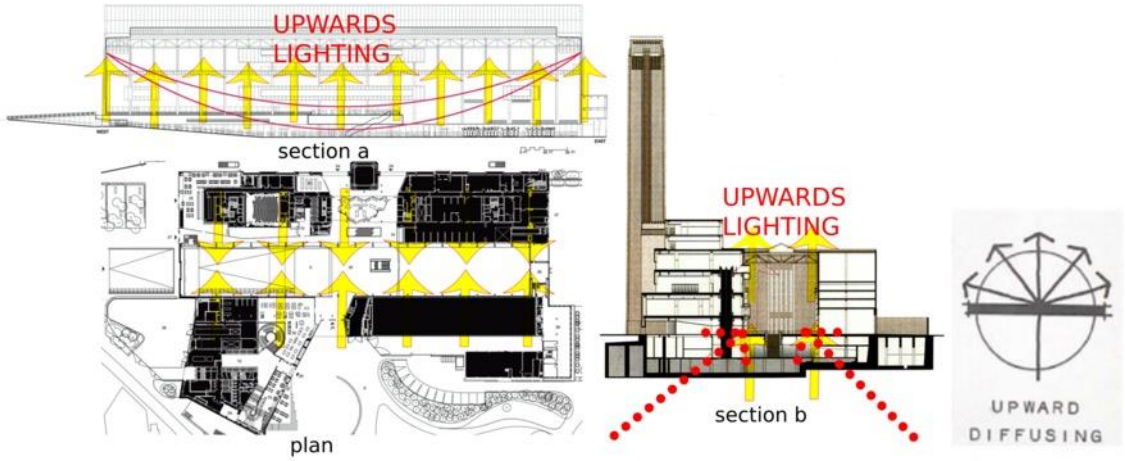

Figure 13: The upward diffused lighting upgrading works for the turbine hall

The glare may happen this ample and spacious area of the turbine hall and sometimes do present the extreme contrast of lighting which is not suitable for the outdoor showcasing for the gallery. A non-uniform brightness condition can be created when low form brightness condition when low intensity or concentrated beam distribution are forming in both upward and downward direction. The upward component is adequate to relieve extreme contrasts in space for the turbine hall. This results in the effective functioning and consequent appraisal of the lighting and hence prepare a new framework to facilitate the activities in the turbine hall(Parsaee et al., 2020).

Sophisticated manipulation of light is key to enhancing the theatrical drama experienced at art galleries. Our lighting team overcame challenges that included developing daylight and electric lighting schemes to enhance the artwork internally while minimizing energy use, without compromising quality. Externally, delivered landscape lighting for the new public space as shown in Figure 14 engage the end-users excitement and thus integrates the extension into the surrounding Bankside.

Figure 14: Theatrical drama experienced with upwards lighting at the turbine hall

GENERAL INDOOR DOWNLIGHTING

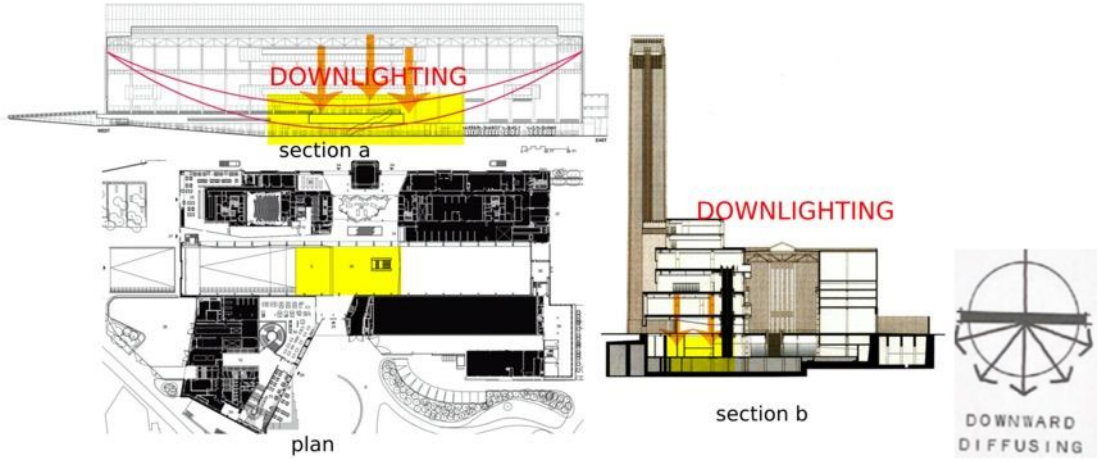

Figure 15: General indoor downlighting at communal spaces such as café and bookstores

The general indoor lighting in the art gallery building should be provided vertical brightness enough to emphasize the most highly positioned area in the hierarchy of display heritage items. The greater the floor area for a given ceiling height, the more efficient is the general lighting system in delivering light to work surface (Flynn & Mills, 1962). For this low ceiling in underneath the mezzanine floor that to the bridge in Level 1 as shown in Figure 16, a higher proportion of light of need to strike the interior spaces and surfaces and hence the implementation of multi-directional downlighting fixture in the narrow hallways is recommended to provide the necessary illumination for the grandeur spaces. (Safranek et al., 2020)

Some studies and applications have been carried out on the natural and artificial lighting of cultural heritage based on the standards for the fruition, conservation and protection of the cultural heritage like what the Tate Modern did. Instead, in general, the heritage issue tends to be resistant to scientific analysis even if it can be a valid support to evaluate lighting in terms of performance and materials light-sensitive (Lassandro et al., 2021).

Figure 16: The creative lighting strategy for Tate Modern had to provide daylight and electric lighting to create a high-quality lit environment for visitors internally with the usage of previous the steel structure from the old power station until nowadays

CONCLUSION

This research discussed the importance of lighting roles in adaptive reuse gallery architecture. Based on the previous study, the light functions in this architectural field can be classified into four strategies, skylight, sunbreak, upwards and multidirectional diffusing downlighting. Determining the building orientation, showcase display area depth with regards to sunlight angle like what Tate Modern refocusing the light intensity need for an adaptive reuse gallery with regards to hierarchal order of the showcase purposes. Today many heritages colonial buildings and structures in Malaysia are full adorned with specific facade and window treatment which is determined by the builder. However, these openings should be then gone through design thinking process which reconsider its illumination application when reusing certain building especially when it comes to different usage or typology in future. With the initiative and application suggested architectural modification without affecting or redoing the main steel structures like Tate Modern gallery, the following principal step will thus guide the designers and professionals in developing heritage zones to accentuate the old monuments with proper mitigation planning:

i. *Integral lighting system and architectural form.* The integration of the light and surface (like the Tate Modern's skylight) should recognize the achievement of brightness function and light control to link the relationship of the south and north riverbank of London
ii. *Visually subordinate lighting unit.* Both indirect and concentrating direct lighting systems involve visually subordinate lighting and hence emplacing the degree of importance for specific display areas in gallery. For example, the main exhibition hall will be the highest position its space planning where it carries the congregational art and showcase programme.
iii. *Visually prominent lighting units.* The effect from outside of interior lighting may be an important part of its function for a gallery that will be a dominant factor in the visual surrounding environment.
iv. *Lighting design as an architectural expression (following & recommendation)*. Based upon the previous study, the light function in architectural field can also be categorized into four groups based on climatic, aesthetic, symbolic and psychological ones. Determination of building orientation, the room's depth with regards to the sunlight angle and its direction, utilizing several elements with openings to reduce the light intensity and application of light well on the roof are the parts that seems to matter in designing lighting in an adaptive reuse gallery.

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