Design Strategies of Sharing Spaces in the Adaptive Reuse of Industrial Heritage Buildings

A Case Study of Deakin University Waterfront Campus

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Abstract. Under the background of post-industrial society and the information age, it is necessary and feasible to set up sharing spaces in the adaptive reuse of industrial building heritages. Australia has many industrial heritages and corresponding reuse cases that are worth learning from. Taking an university campus in Australia, which is transformed from century-old industrial heritage buildings, as an example, this paper expounds on four temporal-spatial forms of sharing spaces (Split, Layer, Time-sharing, and Differentiation). The design strategies of these forms include: (1) divide a room with sharing function in an appropriate position of a plane and connect the room with the surrounding spaces conveniently (Split); (2) demolish part of the large volume building to create an outdoor courtyard and abundant facades for walking around (Layer); (3) set back the ground floor building volumes along streets to form a public standing spaces (Time-sharing); and (4) cancel part of the floor slabs to create indoor atria connecting the roof to the ground floor, and set up a variety of functional areas in and around the atria that are open or separated by transparent interfaces (Differentiation).

Keywords: architectural regeneration; sharing architecture; sustainable reuse; industrial building

1   Introduction

In the post-industrial society, the adaptive reuse of industrial heritage has emerged as a globally significant issue [4, 7]. Concurrently, the advent of the information age has accelerated the development of Sharing Architecture. Hence, exploring design strategies for sharing spaces in industrial heritage buildings holds considerable practical significance. On the one hand, industrial heritage serves as a crucial medium, embodying the questions of "where it comes from", "where it stands now", and "where it is going" [3]. Its adaptive reuse entails adopting adjustment and upgrading measures to make existing structures compatible with new environments [2]. On the other hand, Sharing

Architecture, as a novel design concept closely linked to societal development and technological advancements, is becoming a driving force behind architectural diversity. Nonetheless, there is a scarcity of targeted research on the design of sharing spaces in the adaptive reuse of industrial heritage buildings.

Sharing spaces refer to those that revolve around the interior of a large building or the exterior enclosed space of a group of buildings, integrating multiple functions. There is an inherent feasibility in creating sharing spaces within industrial building renovations. For scattered industrial building clusters, the abundant outdoor environments between individual units offer potential for transformation into sharing spaces. Meanwhile, for centralized, comprehensive industrial buildings, functional shifts necessarily lead to changes in spatial requirements, and the originally tall and spacious interiors provide conditions conducive to the creation of sharing spaces.

This paper takes the educational building transformed from a comprehensive industrial heritage site - Deakin University Waterfront Campus in Australia - as an example. This work illustrates four main forms of sharing spaces through a combination of text and graphics: Split, Layer, Time-sharing, and Differentiation. Additionally, this paper summarizes design strategies tailored to different forms, aiming to provide references for future research and practice.

2   Overview of the case study

Deakin University serves as the affiliated unit of ICOMOS Australia. The Waterfront Campus is in Geelong, Victoria, the second-largest city in the state. It neighbors the city center in the south and Port Philip in the north, offering a distant view of Melbourne, which lies 70 km away. This campus was transformed from a group of industrial heritage sites in the 1990s and now accommodates over 4600 students, teachers, and staff members.

The Waterfront Campus buildings were formerly known as the Geelong Woolstores, comprising eight adjacent structures that once formed one of Australia's largest wool industry complexes. These warehouses, constructed between 1891 and 1954(Fig 1), occupied a total area of approximately 52,000 m^2. Notably, one of the warehouses built in 1901 (Building E) is a registered historic building in Victoria, highlighting its significance. However, due to changes in city functions and industrial restructuring in the late 20th century, the wool processing industry shifted to large single-story factories in the suburbs of Geelong and Melbourne, leaving this complex vacant for an extended period.

The renovation plan for this building complex emerged from a nationwide architectural design competition held in 1992. It encompassed various academic spaces, particularly a series of open or enclosed sharing spaces such as inner courtyards, corridors, and internal streets. To transform these large-span industrial buildings into educational facilities suitable for teaching, research, and cultural exchange while enhancing their industrial heritage value, architects focused on several design aspects. First, the original wooden floor structure was retained as much as possible while complying with contemporary fire regulations, using the existing exterior brick walls to divide the building

into multiple fire zones. Second, outdoor atriums were added to open the dark spaces deep within the building volume. Third, illuminated indoor atriums were introduced to further unlock the potential of the deep interior spaces. Last, the preservation of existing façades was maximized, only modifying certain elements while introducing new open spaces between the building, the city, and the bay. The resulting architectural plan is illustrated in **Fig. 2** [8].
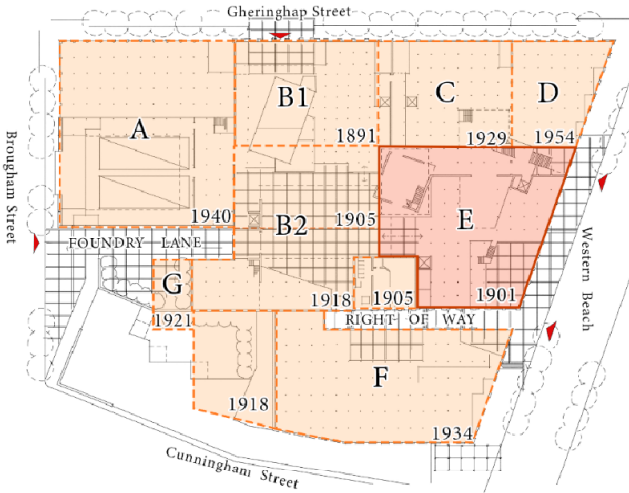

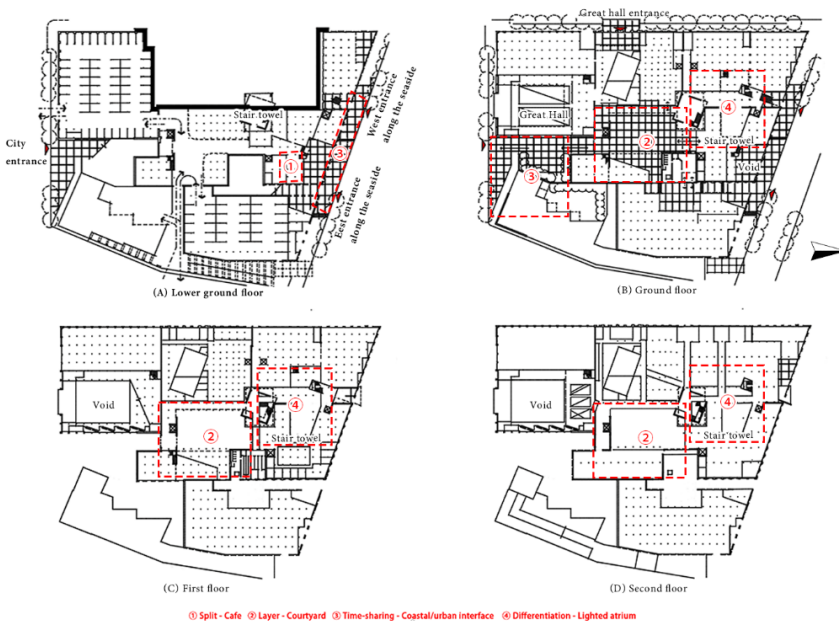**Fig. 1.** Architectural layout and construction years of Geelong Woolstores

Fig. 2. Floor plans of Deakin University Waterfront Campus

3   Forms of sparing spaces

John Portman, a renowned American architect, stands as one of the foremost designers of sharing spaces. Since the completion of his landmark project, the Hyatt Regency Atlanta in 1967, he has continuously embodied the concept of sharing in his hotel architectural designs, thereby leading the evolution of the sharing space design. According to Portman, the design of sharing spaces is rooted in the human desire to transition from confined to expansive environments. The goal of design transcends mere spatial considerations; rather, it prioritizes the human factor. In terms of design approach, sharing spaces should not be confined to a single facade or partial composition but should encompass the entirety of the spatial experience.

Currently, there is no unified classification of sharing space forms within the architectural community. Depending on the subject of the sharing space, it can be categorized as space shared between humans and nature, space shared among people, and space shared between living and working environments. Based on the location, sharing spaces can be divided into architectural spaces, street spaces, community spaces, and urban spaces [1]. This paper adopts a strategy based on the generation of sharing spaces for temporal and spatial classification, specifically dividing them into four forms: Split, Layer, Time-sharing, and differentiation [5, 6]. These four forms are all exemplified in the Waterfront Campus of Deakin University.

3.1   Split

Split is the most fundamental form of sharing spaces, typically involving the allocation of spaces within a larger planar area for common use by different users. At Waterfront Campus, an example of Split is the café located in the northern part of the lower level (**Fig. 2** A and B, ①). Internally, the café enjoys convenient connectivity to the atrium running through the interior via a staircase in the northwest corner, facilitating both pedestrian and visual access between the café and the surrounding workspaces and study areas. Externally, due to site elevation differences, the café is effectively at the ground floor, directly engaging with the coastal landscape. Despite its small size, this café creates a sharing space that is both internally and externally accessible, fostering interaction between the urban environment and the building's interior. The café retains the original slender metal beam and column support system, resulting in a spacious and open interior (**Fig. 3**).

(A) Before reuse   (B) Reuse as a cafe

Fig. 3. The Split form of the sharing space

3.2   Layer

Layer is another fundamental division of the sharing space, representing a vertical expansion of Split. The enclosed outdoor courtyard at Waterfront Campus exemplifies a typical Layer form of sharing space (**Fig. 2** B - D, ②). Its uniqueness lies in the interaction between floors facilitated by the meandering courtyard interface and protruding semi-outdoor corridors. The formation of this space involved processes such as excavation, connection, and interface treatment (**Fig. 4** A - C). Initially, to meet the functional requirements of natural lighting, ventilation, and assembly for educational buildings, the B2 Building located in the center of the building complex was removed, leaving only the surrounding partial framework. Subsequently, the excavated courtyard was connected to the existing north-south passageways, creating a continuous traffic flow. Finally, the surrounding interfaces of the courtyard were refined, directly connecting the surrounding buildings to the atrium on the ground floor and forming an open corridor. On the second floor, open corridors protrude from the south, west, and north sides, while semi-enclosed corridors are formed on the south and west sides of the third floor (**Fig. 5**).
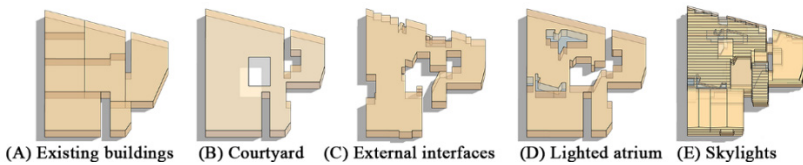

(A) Existing buildings   (B) Courtyard   (C) External interfaces   (D) Lighted atrium   (E) Skylights

Fig. 4. The formation of sharing spaces in Waterfront Campus
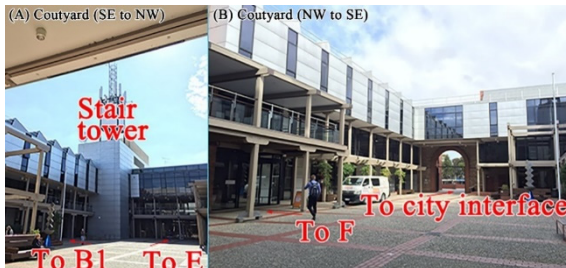

Fig. 5. The Layer form of the sharing space

3.3   Time-sharing

Time-sharing refers to the staggered use of space, representing a spatial utilization strategy. In this case study, Time-sharing is evident in the urban entry interface and coastal entry interface of the buildings (**Fig. 2** A and B, ③). Due to the high density of existing industrial buildings, if a perimeter wall were to be erected around the campus following typical educational building design practices, the site area would become extremely cramped. Instead, the architect opted for a different approach, setback the lower levels to create outdoor spaces directly accessible to the public (**Fig. 4** C). While this approach

may appear to sacrifice some building and site area, it integrates the surrounding spaces, expanding the footprint of the buildings and allowing the setback area to serve both municipal roads and the public (**Fig. 6**). During teaching hours, these interfacial spaces primarily function as transportation hubs and gathering points for students and staff; outside of teaching hours, they are accessible to city residents and visitors.

Fig. 6. The Time-sharing form of the sharing space

3.4   Differentiation

Differentiation represents the evolutionary fusion of spaces, encompassing the decomposition and recombination of functional spaces in the information age. The largest indoor atrium at Waterfront Campus embodies the sharing concept of Differentiation (**Fig. 4** B - D). This atrium was initially located at the heart of the wool warehouse complex, originally characterized by poor natural lighting and ventilation conditions. However, over the past few decades, advancements in information technology have significantly altered student learning habits and the utilization of learning spaces. To a great extent, large and fixed university classrooms have been replaced by various small-scale spaces that cater to anytime, anywhere learning. Consequently, in transforming the wool factory into an educational building, this atrium space was connected to a café below and covered by a skylight above (**Fig. 4** D - E). Its form varies on each floor, providing a rich array of informal learning spaces for students and faculty (**Fig. 7**). Among these spaces, those focused on communication, such as lounges, library cafés, and architecture school galleries, are directly integrated into the atrium. In contrast, learning-oriented spaces, such as reading rooms and seminar rooms, maintain a certain level of separation from the atrium through floor-to-ceiling windows. Regardless of the configuration, there is a strong visual connection and sharing ambiance between the functional spaces and the atrium.
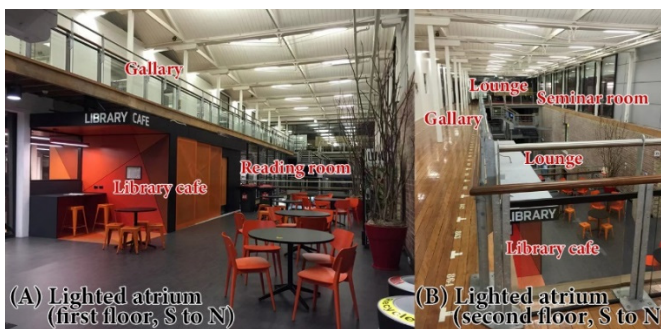
Fig. 7. The Differentiation form of the sharing space

4   Conclusions

"Renewal" and "sharing" are two significant themes in this post-industrial and informational era. It is necessary and feasible to integrate the concept of sharing architecture into the reuse of industrial heritage. Taking Deakin University Waterfront Campus in Australia as an example, this paper expounds on the design strategies of the four forms of the sharing space. Among these forms, Split and Layer are the two basic forms in horizontal and vertical directions; Time-sharing refers to the shared use of space at different times; while Differentiation involves the decomposition and reorganization of large spaces.

To create sharing spaces, design strategies that can be employed for centralized industrial building complexes are listed as follows. First, designating rooms with sharing functions at appropriate locations within the floor plan and connecting them conveniently with surrounding functions (Split). Second, demolishing part of the large-scale buildings to create outdoor courtyards with rich interfaces, which are suitable for wandering (Layer); Third, appropriately setback buildings along the ground level to form public-oriented lingering spaces (Time-sharing). Fourth, removing some of the middle floors of the buildings to create indoor lighted atriums that connect the roof and the ground floor, and arranging diverse functional areas that are open or separated by transparent interfaces within and around the atriums (Differentiation).

In future research, more case studies of sharing space creation strategies in the adaptive reuse of industrial heritage will be analyzed, particularly for scattered and grouped industrial buildings, to extract a set of highly instructive theoretical methods.

Acknowledgements

References

1. Chen G, Xie S, Wang W (2020) Micro renewal of public space in old communities based on sharing concept. Industrial Construction 50:80–84
2. Ding X (2018) "Placeness"and urban industriaI heritage for tourism adaptive reuse：A Case Study of Lowell National Historic Park in Massachusetts，America. Modern Urban Research 68–76. doi: 10.3969/j.issn.1009-6000.2018.07.011
3. Gourlis G, Kovacic I (2016) A study on building performance analysis for energy retrofit of existing industrial facilities. Applied Energy 184:1389–1399. doi: 10.1016/j.apenergy.2016.03.104
4. Huang Q (2020) An anchor point of European route of industrial heritage: Conservation and reuse of the old wastewater treatment plant in Prague-Bubeneč. Heritage Architecture 126–133

5. Li Z (2022) Introduction to Shраring Architecture. China Building Industry Press, Beijing
6. Li Z, Zhu Y (2017) Towards a Sharing Architecture. Architectural Journal 60–65
7. Stašáková G, Kulla M (2016) Sights of industrial heritage and their importance for developing tourism in Slovakia. Geographia Cassoviensis 10:159–174
8. Zhang J, Ding D, Liu C, Luther M, Zhao J, Liu C (2022) Privacy and interaction preferences of students in informal learning spaces on university campus. Facilities 40:638–655. doi: 10.1108/F-11-2021-0119