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Aged urban building adaptation, reuse, and regeneration: Case studies from Hong Kong

The building and construction sector accounts for more than 20% of global emissions and more than a third of global energy demand[1]. Large-scale retrofitting and refurbishment of aging building stock can retain existing structural frames and foundations, which can significantly reduce embodied carbon (the total emissions generated to produce a building, including materials, construction, and related processes), which, on average, is half that of a new build project[2]. There are other benefits, including heritage preservation, improved aesthetics, shorter construction duration, and reduced risk, which are additional reasons why developers may opt for refurbishment over new construction. Below, three case studies are presented from the dense urban landscape of Hong Kong, where Deloitte Hong Kong architecture and planning specialists are collaborating with building owners on renovation and conversion projects.

Adaptive reuse of a convent building

This existing brick-veneered building is part of a cluster of school buildings erected in 1937, which was declared a monument in 2008. The key objective of the project was to drive both social and environmental improvements through upgrading outdated building services systems, improving energy efficiency, and functional replanning to meet current-day requirements.

- Double-glazed windows: Replacing single-glazed windows reduced heat transfer by 22.4% and decreased cooling energy consumption by 10%-15%.[3]
- Operational efficiency: The renovation significantly improved thermal comfort and energy performance during the 50-year operational phase.

Renovation strategy

The renovation strategy prioritized retaining 90% of the existing structure, minimizing material waste and reducing lifecycle carbon emissions. A 27.37% reduction in lifecycle carbon emissions was achieved compared to constructing a new building, with total emissions of 793.19 metric tons of CO2 (tCO2) (renovation) versus 1092.14 tCO2 (reconstruction)[4].

The social and community aspects of the project were equally important. Through a series of subtle architectural interventions, the modernized building was designed to be accessible in accordance with Hong Kong's 'Barrier Free Access' building code (2008), including those with disabilities, by incorporating features such as ramps and wide doorways, while preserving the building's historical elements. Additionally, a new exterior forecourt was formed, acting as a social connector to the rest of the campus, providing valuable outdoor space that extends the functional footprint beyond the walls of the small building.[5]

In addition to its social, community, and sustainability benefits, the project's cost considerations were also significant. While the building is currently at the main contractor tender stage, and final renovation costs are yet to be determined, preliminary analysis suggests that renovation projects often have a lower embodied carbon footprint and, on average, can cost up to half as much as a new build project. However, it is important to note that actual costs may be subject to change due to potential variation orders during construction, and a precise comparison between renovation and new build costs will only be available upon project completion.

This case study highlights the importance of sustainable design, lifecycle thinking, and heritage preservation in urban development. By prioritizing adaptive reuse, the project demonstrates how aged buildings can be transformed into models of environmental and social performance, fostering community engagement and cultural preservation.

Conversion of an industrial building into a lifestyle hub

One of the first projects to be approved under the Hong Kong Government's policy to revitalize older industrial districts in the territory, this 16-storey industrial building was gutted and reconfigured into a lifestyle building comprising offices, shops, and food and beverage outlets. By surgically removing existing floor plates, double-height spaces were strategically located around the building to compensate for suboptimal floor-to-floor heights.

The lobby serves as a publicly accessible art gallery and cultural beacon for the district, which has gained a reputation as an artist enclave in recent years. Multi-level roof terraces connect to restaurant spaces throughout the building, supporting a variety of usage scenarios both day and night.
Natural terracotta cladding makes reference to the colors and character of the original neighborhood, while high-performance insulated glass units provide enhanced energy performance.

The project is targeting Building Environmental Assessment Method (BEAM) Plus Silver certification, which is the local Hong Kong green building accreditation system, demonstrating achievement in areas such as material usage, effective waste management, and indoor air quality.

Retrofitting of a secondary school

Located in the eastern part of Hong Kong Island, this secondary school occupied a 14,000-square-meter building that was over 20 years old. Energy consumption was a significant challenge for the operations of the school, with HVAC (Heating, Ventilation, and Air Conditioning) systems accounting for 65% of annual electricity consumption[6]. Other resource usage, such as water consumption, waste management, and transportation, also required optimization, providing a foundation for targeted renovation plans.

Innovative adaptive reuse approaches

The renovation project uniquely combined technological innovation with community engagement.

- **Energy efficiency and renewable energy integration**
  A 750-square-meter photovoltaic system, which uses solar panels to convert sunlight into electricity, was installed on the roof and surrounding areas. Based on solar radiation analysis and standard calculation methods, the system is estimated to generate approximately 136,900 kWh of electricity annually[7]. In addition, IoT (Internet of Things) smart HVAC and lighting systems have been implemented to help optimize energy use based on occupancy and environmental conditions. Together, these technologies can provide an integrated approach to active energy efficiency by combining renewable energy generation with intelligent energy management. As a result, the school can achieve significant cost savings.

- **Behavioral and educational measures**
  Workshops, energy-saving activities, and carbon footprint calculators encourage sustainable practices among teachers and students, while a carbon accounting system (a method for measuring and tracking carbon emissions) promotes awareness and reduction of carbon emissions within the school community.

- **Sustainable implementation**
  Renovation works were planned in carefully delineated phases to help minimize disruption to school operations while maximizing renovation benefits.

Social impact

The renovation project brings multiple benefits:

- **Education and behavioral change**
  Sustainable practices are integrated into the curriculum, with activities like recycling competitions and low-carbon cooking reinforcing students' environmental awareness.

- **Environmental performance**
  The project is expected to reduce annual carbon emissions by 60-70%, with remaining emissions offset through carbon trading.[8]

- **Community engagement**
  The project creates a platform for collaboration among teachers, students, and the community, enhancing unity and responsibility through environmental activities and recycling programs.

This renovation project demonstrates how adaptive reuse and regeneration of old buildings can promote social and community development while enhancing environmental benefits. By integrating technology and community participation, the project sets an example for sustainable urban renewal, showing how current needs can be met while preserving the planet.

These cases provide valuable insights for urban renewal projects, demonstrating that old buildings can be transformed into functional, sustainable spaces.

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Endnotes:

1. UN Environment Programme, Global Status Report for Buildings and Construction: Beyond foundations: Mainstreaming sustainable solutions to cut emissions from the buildings sector, p. 1
2. Net Zero Carbon Guide, Retrofit or New Build? p. 1
3. Hong Kong Housing Authority, Energy Efficiency Regulation (APP-67), 1995
4. Ministry of Housing and Urban-Rural Development of the People's Republic of China, Standard for Calculation of Carbon Emissions in Buildings (GB/T51366-2019), 2019, p. 22, 26, 47
5. 1 Accessibility features were implemented in accordance with Hong Kong's 'Barrier Free Access' Code (1997). GBP drawings were approved by the Hong Kong Building Department.
6. Hon Wah College in Hong Kong, Utility bills for electricity, water, and gas, October 2021–September
7. Estimated annual energy generation is based on site-specific solar radiation analysis, assuming 750 square meters of photovoltaic panels, a generation efficiency of 100 W/square meter-hour, and an average of 5 effective sunlight hours per day throughout the year.
8. WCWP, Carbon Neutrality Renovation and Sustainability Proposal for Hong Kong Hon Wah College, 2024

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