

Investigation and Development of Innovative Façade Design Strategies for Daylight Modulation in Multistorey Buildings

The building sector currently accounts for around 40% of global energy use and GHG emissions and there has been significant research in the recent decade in several engineering disciplines to upgrade building performance with the minimum disturbance to the building interior conditions. As countries race to build climate resilience, the shift from low-density suburban to high-density urban has recently emerged as an effective solution for a broad reduction in grid emission rates and fuel consumption. There are solid empirical studies that confirm the role of urban densification as a significant component of energy conservation transitions. A dense urban context, however, is also a source of sun shading and has a substantial impact on interior daylight access in buildings. To give a brighter spotlight to a building's adaptability to increasing urban density, this research intent is to investigate various passive envelope options for adding to the designer's palette to modulate daylighting access in mid-rise and high-rise buildings in a dense urban context. The building façade is the boundary layer for exterior environments and a regulator of interior microclimates. Envelope retrofits tended to rank better than energy-intensive upgrades in terms of carbon reduction per dollar spent, and innovative façade technologies have been undergoing continuous evolution and improvements in recent years. This research thus first seeks to identify effective design strategies and practical considerations related to the successful designs that demonstrate efforts to benefit from exterior climate conditions to provide adequate daylight in buildings. In this research, innovative design packages which include practical roadmaps of building fenestration renovation for better glazing, shading, and solar gaining as well as functional patterns of building enclosure designs for better interaction with the ambient environment are being explored for optimal daylight control in multistorey buildings. As the outcomes of the investigation, the research then proposes a framework on how to fundamentally promote daylighting efficiency and achieve the best outcome in buildings through deployable structural components that are directly applicable to the vast majority of the future global building stock.

Keyword 1

Innovative façade technologies

Keyword 2

Daylighting access modulation

Keyword 3

Urban densification

Keyword 4

Keyword 5

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Session Classification: Posters

Track Classification: Inside Daylight