Development of Regenerative Design Principles for Building Retrofits

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Research Questions

1. How can regenerative design outcomes be implemented into building retrofits?

2. What are the building retrofit design principles for improving the connections between human and natural systems within the built environment?
Research Objectives

• Develop a regenerative design model and principles for building retrofits.
  
  – Generate positive impacts on both human and natural systems.

  – Improve the interactions between a building and its surroundings.

• Demonstrate the proposed regenerative design principles for building retrofits with examples.

Seven Net-Positives

CIRS was designed to be ‘net positive’ in seven different ways—net-positive energy; structural carbon neutrality; operational carbon; net-zero water; turning passive occupants into active inhabitants; promoting health and productivity; and promoting happiness.
A regenerative building retrofit would seek to improve its environmental performance whilst (re)connecting with and positively impacting on human and natural systems.
Research Framework (Potential Retrofit Interactions)

- 3 dimensions - physical environment, human systems and natural systems.
- Retrofitting is predominantly at the building scale with a focus on energy efficiency and how this impacts human systems.
- Need to cross between all three dimensions to go beyond a building scale and connect with surrounding natural systems.
Research Framework (Example Principles – Under Development)

1. **Renewable Energy Potential**
   Consideration of existing building’s context to determine the appropriate use and location of renewable energy generation.

2. **Positive Energy Exchange with Surrounding Environment**
   Effective energy management and storage systems to facilitate positive energy exchange with surrounding buildings, infrastructure and the grid.

3. **Upgrade Existing Energy Systems**
   Upgrading or replacing building central plant, improving appliance and lighting efficiency and integrating energy management systems.

4. **Integrate Passive & Natural Systems into the Building Envelope**
   Roof and façade are to incorporate passive and natural design strategies to actively reduce the building’s energy demand.

5. **Material Compatibility with Surrounding Environment**
   Ensure any new and existing materials are compatible with the climatic, cultural and aesthetic conditions of the building.

6. **Improve Construction Quality & Integrity**
   Consideration and improvement (if necessary) of existing building’s structural support systems, moisture control and air infiltration/leakage to expand potential retrofit options.

7. **Enhance Visual & Physical Comfort**
   Direct and indirect connection to nature, internal and external views, daylighting and spatial layout that is conducive to improving occupant health, comfort and productivity.

8. **Improve Indoor Environmental Quality through Natural Systems**
   Introduce nature and natural systems into the building as a means of improving thermal comfort, ventilation and indoor air quality.

9. **Provide Opportunities for Social Interaction**
   Provision of internal and external public space that encourages appropriate social interaction for occupants.

10. **Enhance Urban Ecosystem Capacity**
    Selection of contextually appropriate plant species for green roofs and living walls to increase biodiversity by providing urban natural habitats.

11. **Urban Microclimate Mitigation**
    Shading heat absorbing surfaces with vegetation and suitable building envelope material selection to reduce the urban heat island effect.

12. **Retrofit for Resilient Buildings**
    Ensure building retrofit design is proactive towards climate change adaptation to minimise future building impacts and to maintain healthy ecosystems.
Research Challenges

Most current building retrofits do not have enough focus on realigning human and natural systems and do not go beyond the building footprint.
Research Challenges (Principles as a way to address this challenge)

- Improve IEQ through Natural Systems
- Provide Opportunities for Social Interaction
- Positive Energy Exchange with Surrounding Environment
- Enhance Urban Ecosystem Capacity
- Enhance Visual & Physical Comfort
- Improve IEQ through Natural Systems
Outcomes & Impacts

This research will assist designers and decision makers to:

• Incorporate regenerative concepts into the building retrofit design process.

• Consider how an existing building can positively interact with its surrounding human and natural systems.
