

Circular economy strategies for adaptive reuse of cultural heritage buildings to reduce environmental impacts

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Annex I

Circular Economy Strategies for Adaptive Reuse of Cultural Heritage Buildings to Reduce Environmental Impacts

Annex Table 1		
Connecting Circular Environmental Strategies for Adaptive Reuse of Cultural Heritage Buildings to Reduce Environmental Impacts to Building (Project) Lifecycle Phases		
Circular Environmental Strategies		Links to Phases
1 DESIGN		
1.a	●●Design for energy efficiency including passive methods	4, (3)
1.b	●●Minimize or eliminate need for new construction materials by reducing space and multi-tasking space	2, 4
1.c	●●Substitute non-renewable energy supply with purchased or produced renewable energy	2, 3, 4
1.d	●●Use local and culturally significant materials	2, 3, 4, 5
1.e	●●Consider environmental impact scenarios in design selection (produced and avoided wastes, embodied energy & emissions)	4
1.f	●●Recover water and energy	2, 3, 4
1.g	●●Increase or maintain green space	3, 4
1.h	●●Plan for long term climate change due to weather-related risks such as flooding	3, 4
1.i	●●Plan for long term climate change by choosing flexible heating and cooling	3, 4
1.j	●●Enhance lifespan maintainability	3, 4, 5
1.k	●●Design achieves Green Building certification (LEED, BREÉAM, DGNB)	4

1.l	••Structure foundation and building corpus to make ready for different uses in the future	4, 5
1.m	••Design for disassembly	5
1.n	••Enhance material durability to extend lifespan	#
1.o	••Historic and/or cultural heritage listing/designations	2, 5
2 BUILDING MATERIALS SOURCING		
2.a	••Reduce transport by choosing local sourcing	(4)
2.b	••Substitute fossil fuel intensive materials with bio-based materials	3, 4
2.c	••Substitute new materials with used materials wherever possible	(4)
3 BUILD		
3.a	••Limit disturbance of trees, soils and habitat	1, 4
3.b	••Increase or maintain green space	1, 4
3.c	••Revive traditional construction techniques and materials	1, 2
3.d	••Use abandoned or neglected cultural heritage sites	1, 2
3.e	••Implement brownfield development through hazardous waste remediation and/or solid waste removal on site	1, 5, (4)
3.f	••Reuse salvaged materials from other demolitions	1, 2
3.g	••Recover materials from project	1, 2

4 USE & OPERATE		
4.a	●●Recover water and energy with modern and historical/cultural technology and design	1, 2, 3
4.b	●●Implement, incentivize, and encourage users to achieve high rates of product reuse and recycling	1, 3, 5
4.c	●● Strive to increase proportion of purchased and produced renewable energy whilst phasing out fossil fuels	1, 3
4.d	●●Implement ongoing energy efficiency strategy	5, (1)
4.e	●●Measure energy efficiency continuously	(1)
4.f	●●Implement use arrangements that meet needs without individual ownership (i.e., shared office, laundry, conference spaces)	1, 3
4.g	●●Implement fee for service contracts that reduce material inputs and incentivize longevity such as paying for light rather than electricity for lighting, copying services rather than copiers, flooring services rather than owning carpeting	#
4.h	●●Promote and incorporate local and regional agriculture	#
4.i	●●Ensure public access to greenspace and other spaces	1, 3
4.j	●●Create habitats for animals and insects	1, 3
4.k	●●Improve users quality of life	#
4.l	●●Improve land through pollutant remediation and/or increasing nutrients in soil	3, (1)
4.m	●●Improve users low carbon mobility options	1, 3
4.n	●●Measure health impacts e.g., indoor air quality	(1)

4. o	●●Provide facilities for easy collection of recyclable materials and biomass for compost	1, 3, 2
5 REPURPOSE & DEMOLITIONS		
5. a	●●Evaluate options for transformation and adaptive reuse	2
5. b	●●Implement material passports to facilitate reuse	2
5. c	●●Communicate availability of a heritage site for adaptive reuse and/or rehabilitation	2
5. d	●●Implement dismantling and disassembly and recovery rather than complete demolition	1, 2, 3
5. e	●●Create new value chains from demolition wastes, e.g., gypsum to fertilizer, lumber to wood flooring	3
5.f	●●Utilize materials for energy recover when no alternative to landfill	#
# = Strategy is not linked to other building lifecycle phases.		

The color of each strategy in Annex Table 1 indicates its level of circularity per Figure 5 in the paper.

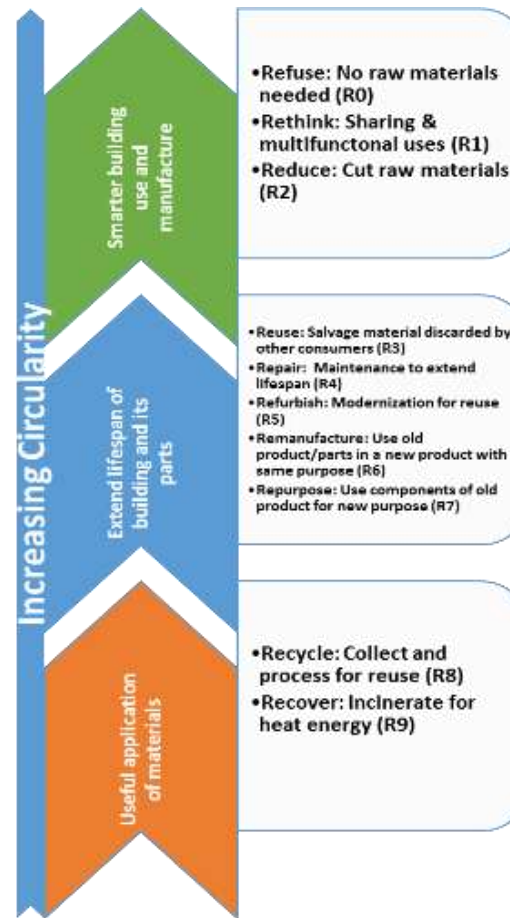


Figure 1: Ascending circularity strategies indicating order of priority