Buildings for sustainability (in tropical climates): An overview

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We need buildings to lead our lives. However, buildings – i.e., built environments – contribute against sustainability especially if not properly planned, designed and constructed.

Being an evolving concept, sustainability is not well defined. However, it underpins the humankind's future and, to a lesser extent, its present. Out of a host of definitions, that of the World Business Council for Sustainable Development (WBCSD) presents an overall image of this concept: "Sustainable development is forms of progress that meet the needs of the present without compromising the ability of future generations to meet their needs".

Based on a discussion with Professor Thishan Jayasinghe (Professor of Civil Engineering, University of Moratuwa, Sri Lanka, www.mrt.ac.lk), this article looks into how a building's adverse effects on sustainability can be mitigated or even prevented. In certain areas, it presents methods to use a building to positively contribute to sustainability.

This discussion is limited to buildings in tropical climates.

The resistance of a typical building to sustainability – to the environment in particular – can be summarized under the following areas:

1. Materials used for construction of the building
2. Construction of the building
3. Presence of the completed building
4. Use of the building
5. Changes, repair and maintenance of the building

This article presents an overview, covering all these areas. Three subsequent articles will discuss each aspect in more detail. Note that a multi-storey building can accommodate the desirable features more effectively than an equivalent single storey one.

Materials

- Make maximum use of the natural resources already used for conventional building materials (e.g., efficient use by way of efficient structural systems or high strength materials, recycling of construction waste)
- Reduce the use of conventional building materials and use environment-friendly alternative materials (e.g., cement-stabilized soil blocks, rammed earth)
- Reduce the consumption of non-renewable energy resources. Turn to energy generated from environment-friendly renewable sources (e.g., wind, wave energy, solar) and use alternative fuels (e.g., industrial waste)

Construction

- Avoid building construction at or near ecologically sensitive locations or sloping land
- Reduce the building's plot coverage (e.g., multi-storey option)
- Reduce fuel consumption by using locally available materials for construction
- Efficiently use the construction plant and equipment
- Avoid environmental pollution by properly managing construction waste

Presence

- Minimize the removal of existing vegetation (e.g., multi-storey option)
- Create a thermally desirable microclimate around the building by planting trees around the building
- Adopt innovative measures to further increase the vegetative cover (e.g., roof garden, ivy on exterior wall surfaces)
- Paint exterior wall surfaces with light colours
- Avoid creation of an impermeable layer around the building (e.g., cement tiling, rendering, ground concreting)
- Avoid surface materials that release toxic contaminants to air
- Resort to more natural surface materials (e.g., mud plasters)
- Ensure good natural ventilation indoors to flush out contaminated indoor air
- Build a rainwater detention pit with an unlined bottom to promote groundwater recharge and to demote flashfloods

- Adopt rainwater harvesting for flushing toilets
- Note that a multi-storey building can facilitate these features more effectively than an equivalent single storey one

Use

- Achieve acceptable indoor thermal and visual comfort levels through a passive approach (i.e., planning and design of the building as an environment friendly, passive building).
- Create a thermally desirable microclimate by planting trees around the building
- Insulate the roof or the ceiling and ventilate the attic space between the roof and the ceiling
- Provide openings (i.e., windows) facing a shadable direction (i.e., north or south) and shade the openings with horizontal overhangs (a projection of 0.8m is adequate)
- Ensure that, if there are openings facing west or east (west is worse), they are short and protected by an overhang with a longer projection
- Locate spaces for which thermal comfort is not important (e.g., storeroom) on the thermally most undesirable west side
- Face the building to a shadable direction (e.g., north or south) so that the large openings of the front façade has a shadable orientation (This can be done by planning access roads along east-west direction)
- Improve indoor ventilation by forcing wind to change its direction inside the space (e.g., when a space has two perpendicular external walls, provide openings on both walls)
- Include a courtyard will louvers facing undesirable orientations so that the spaces around the courtyard can have windows opening to the semi-outdoor environment without being exposed to sun
- Provide appropriate openings to depend on daylight for acceptable indoor visual comfort levels during the daytime
- Avoid tinted glass for windowpanes to facilitate ingress of daylight
- Paint internal walls, too, with light colours to spread diffuse light better
- Use energy efficient compact fluorescent lamps (e.g., for visual comfort during the nighttime)
- Reduce waste generation at buildings (e.g., reuse)
- Treat grey water from showers, sinks and laundry and reuse for flushing toilets
- Note that a multi-storey building can facilitate these features more effectively than an equivalent single storey one

Changes, repair & maintenance

- Plan the building with careful consideration for future requirements in order to minimize subsequent changes
- Use good quality and durable materials ensuring a high level of workmanship during construction
- Design buildings with disaster resistance to minimize damage during a disaster
- Properly manage waste arising from changes and repair

NOTE

Eng (Prof) Thishan Jayasinghe, B.Sc. Eng. (Moratuwa), Ph.D. (Cambridge), C.Eng, MIE(SL), graduated in 1987. He completed Ph.D. in 1992 and then worked at the Department of Civil Engineering, University of Moratuwa, for the last 15 years. His research interests are in the areas of tall buildings, masonry structures, long span bridges, energy efficient buildings and sustainable development.
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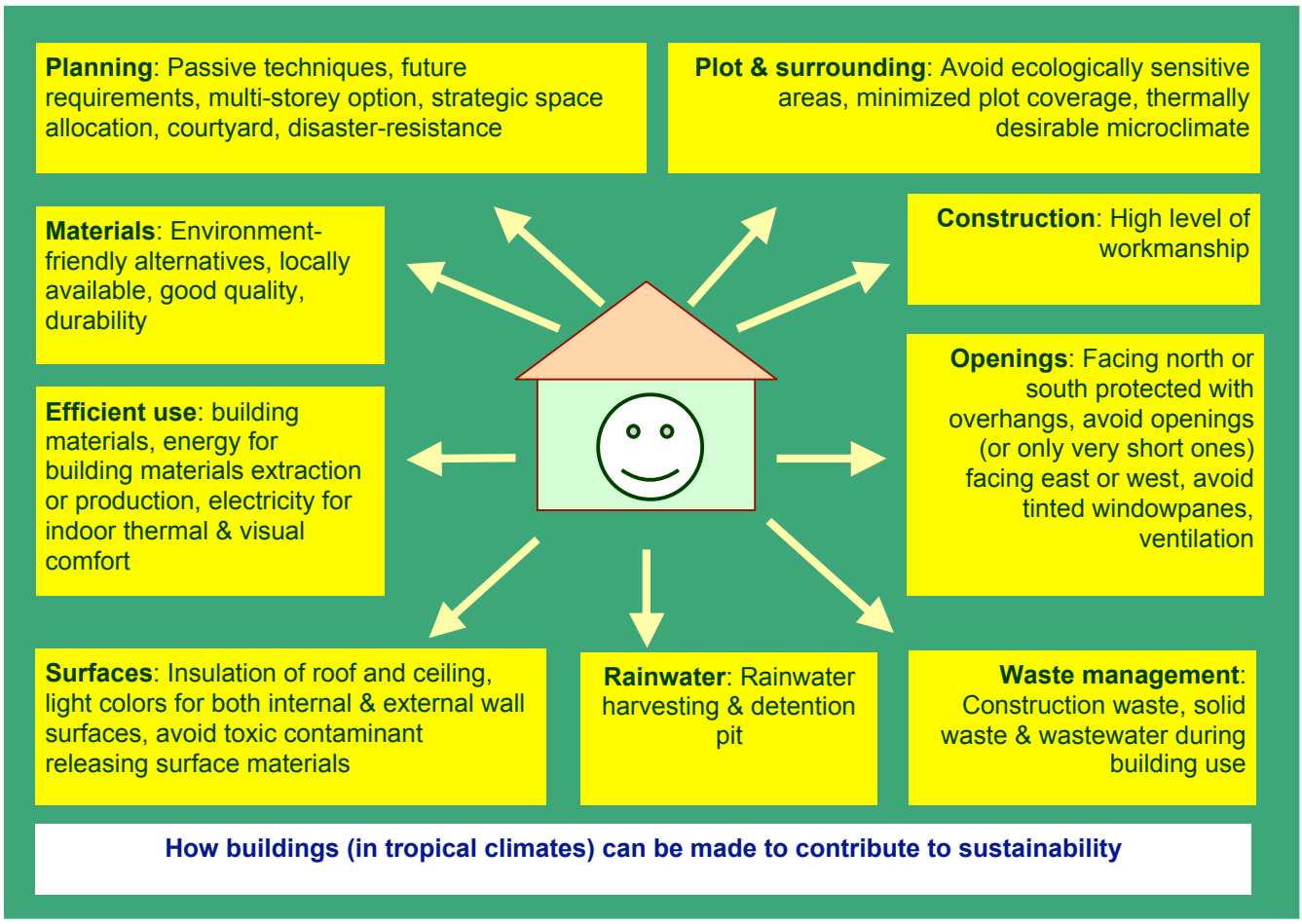

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