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1. **Site analysis (context, topography and climatic data):** Retrofit existing poor buildings and give preference to brownfield sites over undeveloped green fields. Assess the local context including the topography of the site. Collect data on temperature, relative humidity, wind’s speed and direction, solar path and radiation, over at least one year.

2. **Building footprint:** Conform to the permitted ground coverage and should ideally cover not more than 60% of the plot.

3. **Building orientation:** Design the long axis of the building to be along East-West to minimize direct solar radiation penetration in the building and reduce heat gain. Always indicate the North direction in all plans.

4. **Building form/shape:** Design according to climatic zone. For hot-humid region, use narrow plans to maximize natural light, cross-ventilation and minimize heat gain. For hot-arid regions, use compact forms with courtyards to retain cold air in the building and minimize heat gain. Give preference to multi-story building to increase density and maximize resources.

5. **Allocation of spaces within the building:** Services e.g. toilets, staircases, lifts, lobbies, kitchens etc. to be located on the East and West facing walls to act as buffer zones against heat gain but benefiting from daylighting.

6. **Openings:** Window sizing to be designed according to prevailing climatic conditions, and placement preferably on North and South walls; wall to windows ratio should not exceed 40%. Gazing walls should be avoided, unless using special treated glass.

7. **Daylighting:** Design buildings according to climatic region, with openings on North and South walls, narrow plans to maximize daylighting, use clerestories & light shelves in deep spaces; staircases, toilets, & kitchens to be day-lit. Window area should be at least one tenth of the floor area. The depth of the room should not exceed 2.5 times the height of the room.

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9. **Natural ventilation:** Ensure that both cross-and vertical ventilation are provided by the openings. Make use of roof vents and openings, thermal chimneys and clerestory windows. Make use of insulation materials under the roof sheet and design ventilated roofs.

10. **Cooling:** Integrate passive cooling systems by designing water bodies and features for evaporative cooling in hot and arid regions. Ensure that buildings using air conditioning appliances are well insulated to limit heat gain and reduce energy demand.
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![Building floor plan with East and West walls highlighted]

## Openings

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![Examples of window wall ratio (WWR) 30%, 50%, 100%]

## Urban Form Matters

- Support mixed use, street life and walkability by designing compact blocks and buildings.

![Urban form diagrams with mixed use buildings and public spaces]

## Walkability

- Favor pedestrian mobility by emphasizing on walking distances, mixed use and public transport.

![Walkability diagrams with pedestrian routes and mixed-use areas]
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- Promote social integration and diversity.
- Encourage cosmopolitan values and the need to live together and avoid gated communities.
- 20 - 50% of residential space should be allocated to affordable housing.
21 Well balanced public spaces

- 50% of spaces should be allocated to streets, roads, public spaces, gardens and parks (30% for streets, 15% open space).

22 Mixed land use

- Avoid zoning by combining economic, administrative and residential activities.
- This reduces the need to travel and ensures the use of public space.

11 Heating

- Suitable for highland regions where passive heat gains through direct solar radiations are welcome in the building during the cold seasons.
- Design passive solar heating strategies to ensure maximum sun penetration during cold seasons.

12 Building envelope and materials

- Always consider the carbon footprint content while choosing building materials.
- Give preferences to locally available building material that are more appropriate with low energy content.
- Consider recyclable and re-usable materials with low toxic emissions.
- Give preference to envelopes (wall and roofs) with low U-value or low heat transmittance properties.
External finishes

- Make use of light-colored materials on external facades and roofs to reflect excessed solar radiation, while also incorporating green and living walls, vertical gardens provided with vegetation that grows on the facades.

Renewable energy

- Integrate solar energy (thermal and electricity) such as photovoltaic and solar water heaters; wind energy, biogas and other available renewable energy systems into the building design.
20 Energy-efficient appliances and Energy demand management

- Incorporate energy saving appliances in the building design.
- Make use of energy-saving bulbs, light level sensors, occupancy & motion sensors.
- Encourage behavior change.
- Ensure that energy demand management principles are given top priorities by the building occupants.

A radar chart to assess the sustainable performance of the building

15 Water conservation and efficiency

- Design rainwater harvesting systems.
- Recycle grey water.
- Use water efficient appliances and water-saving fixtures.

16 Drainage

- Provide appropriate drainage technique to mitigate storm water run-off and facilitate replenishment of water table through rainwater infiltration.

<table>
<thead>
<tr>
<th>KEY</th>
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<tbody>
<tr>
<td>0 - 25</td>
<td>Sustainable design measure not considered</td>
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- In the absence of municipal sewage system, design on-site waste water treatment systems with production of biogas, compost and re-used of water for irrigation.

Solid waste management

- Design provisions for waste separation with on-site sorting facilities. Introduce innovative systems that encourage the 3R actions: Reduce, Recycle and Reuse.

Landscaping

- Design soft landscaping (greening site) with indigenous plants that require minimal irrigation and hard landscaping with paving materials that allow rainwater permeability.
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**Location: Dares Salaam, Tanzania**

**Climatic zone: HOT HUMID**

- Zone 1: Comfort zone
- Zone 2: Natural ventilation zone
- Zone 3: Evaporative cooling zone
- Zone 4: High thermal mass
- Zone 5: High thermal mass and night ventilation
- Zone 6: Passive heating

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