SUSTAINABLE CLIMATE RESILIENT INFRASTRUCTURE

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Abstract:
The climate resilient infrastructure is important now a days in order to get rid of impacts to structures due to climatic change and is a key component to economic, societal and environmental viability

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1.INTRODUCTION

The defining characteristic of climate-resilient infrastructure is that it is planned, designed, built and operated in a way that anticipates, prepares for, and adapts to changing climate conditions [1].

2.IMPACTS OF CLIMATE CHANGE ON INFRASTRUCTURE

Infrastructure will get affected by climate change if the structure is not properly constructed as per the climatic conditions of the area like damages to roads, airports, bridges due to flooding, damages to roads due to abnormal increase in temperature, increased evaporation from reservoirs due to increase in temperature etc. Climate change even leads to injuries to people and even it may lead to deaths.

There are different types of impacts such as regional scale impacts, neighborhood design and form impacts, neighborhood scale impacts and site scale impacts. Regional scale impacts include urban areas and systems which was implemented in the favor of social, economic and environmental wellbeing. Systems include energy, water and transportation systems. Energy supply may get affected due to climate change. Flooding and disruption in water supply may be resulted due to the climate change. Extreme weather conditions may impact the safety of the transportation system. Neighborhood includes the location of the individual sites with reference to regional context. While constructing the building in coastal areas, some factors such as sea level rise, flooding and wild fires are to be considered. In case of site scale impacts, effects on water management, storm runoff, decreased ability of natural ventilation, heat waves intensity etc., are to be considered[2].

3.IMPORTANCE OF THE CLIMATE-RESILIENT STRUCTURES

The climate-resilient structures reduce the damage to structures by means methods of adoption of structural and non-structural measures. Structural adaptation measures like using the paving paths as permeable nature to reduce the runoff during heavy rainfalls. Non-structural measures like Ecosystem-based approaches like monitoring of existing assets to reduce the structure failure due to climate change.

4. GENERAL APPROACHES

Actions that can be taken during three phases of time to improve the resilience and reduce vulnerability of the structure and communities includes prior to the event, during the event and long time after the event [3].

4.1. The role of institutional policy frameworks in adapting the built environment

The national government and policy makers hold the most important responsibility and have the power to plan, influence and implement changes necessary for vulnerability and disaster risk reduction (Vahanvati,2018).

4.2. Building Codes

Building codes are very much useful to know how to construct buildings, which materials are to be used and how much energy is to be consumed to reduce vulnerability and to incorporate safety.

4.3 Design and construction principles

4.3.1. Human- climate-building interactions

Occupant behavior complicates the interaction between the building and the climate.The essential principle is based on the human response within the building. Buildings provide a level of comfort in order to cope with the climate; in addition, people control elements of the building to improve their comfort further. Energy use is influenced by climatic, social, economic and cultural contexts. Building users approaches are to be considered.

4.3.2. Owner-driven reconstruction for adaptation

The owners have the authority of decision-making power throughout the entire process of reconstruction through policy framework implementation [4].Owner-driven housing reconstruction (ODHR) has become the preferred option and is actively promoted by a host of international organizations.

4.3. 3. Frangible architecture or “planning for damage”

Frangible architecture is the intentional design of walls, roofs or other structures so that they give way in face of high winds, flood-waters or other extreme events. Life and property can be protected through protection of the building through mitigative measures.

4.3.4. Triage design for rapid reconstruction after disasters

Triage focuses on quick repairs after a hazard event. Triage includes ease with which the reconstruction can be made with materials at minimum. Design for Deconstruction (DfD) involves the principles like design for prefabrication, preassembly and modular construction, simplify and standardize connection details, simplify and separate building systems and minimizing building parts and materials [5].

4.3.5. Nature-based adaption for design and construction

Green infrastructure (GI) is a “nature-based solution”. Green infrastructure utilizes natural methods in improving the sustainability and offers a solution to municipalities to provide services of protection at a lower cost. Rain water collection system, green roofing are the some of the measures of flood risk.

5. ADAPTATION IDEAS FOR THERMAL REGULATION AND COMFORT

5.1. Building site and orientation

To adapt to increasing temperatures and to mitigate overheating, a building’s performance can be significantly impacted by where on a site it is placed. Existing or planned elements, such as trees and other buildings, can provide shading or adversely block the sun when it is needed. The setting of plan of the building on its site with reference to the directions is known as orientation and is most important.

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The following are some of the points that needed for good orientation of the buildings in tropical climate:

(i) Cross Ventilation

Sufficient number of windows and ventilators at suitable level from the floor should be providedfor the movement of air.

(ii) Damp proof course

Providing damp proof at suitable level- keep away walls from damp

(iii) **Placing of walls**

Longer walls of building should be towards N and S.Shorter walls of building should be towards East and West. Exposing less area of wall to the sun rays for maintaining comfortable temperature inside the building.

Iv)Projections: Balconies, verandahs, weathersheds etc., should be provided on east and west sides so that adjoining rooms will be cool

(v) Roof

R.C.C. flat roofs should be provided with water proofing treatment.

(vi) Treatment of ground

Ground surrounding the building is provided with grass or trees or vegetation so as to reduce the temperature inside the building.

(vii) Wind direction

The orientation of the building should be in such a way that it enjoys the natural breeze.

The figure 1 indicates building management system to optimize the energy consumption.

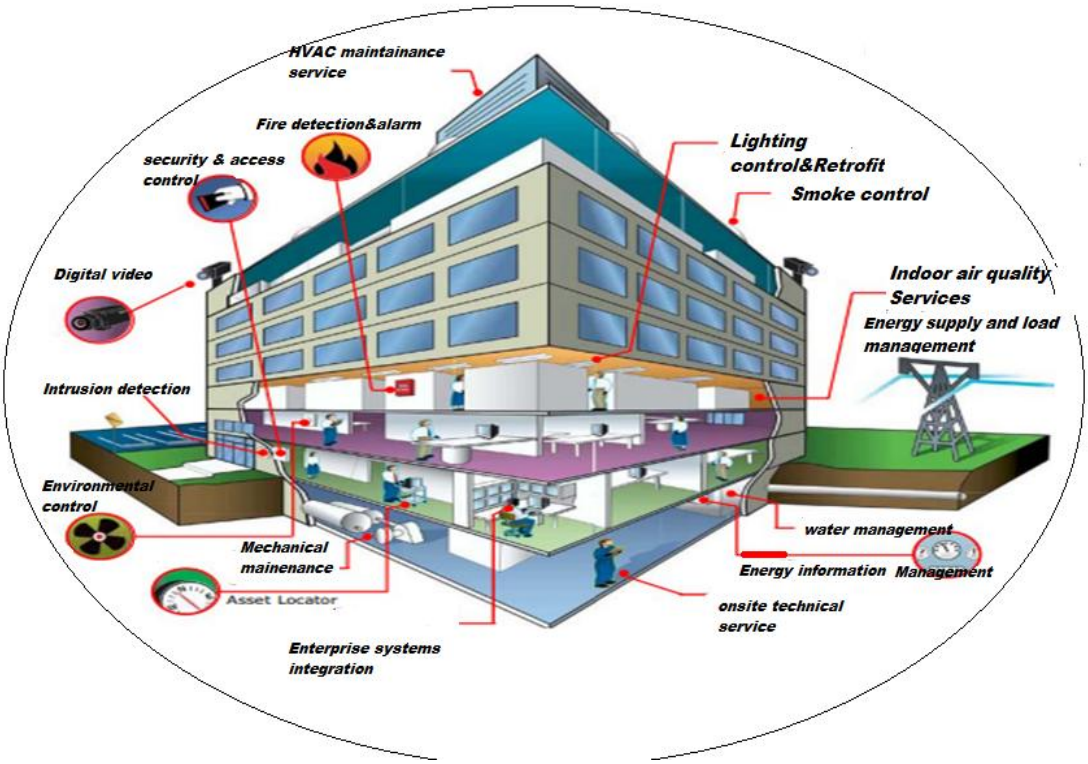

Fig.1 Building Management system-optimize energy consumption (Source: Bulletin, IGBC)

5.2. Green Building Materials

Rapid renewable wood, concrete prepared from fly ash can be used as green building materials to achieve sustainability.

6. ADAPTATION IDEAS FOR SPECIFIC CLIMATE RISKS: FLOODING, DROUGHTS AND CYCLONES

6.1. Adopting to changing rainfall patterns and droughts

The risk due to increase in rainfall can be decreased by means of providing water harvesting measures and second is to increase the area of seepage of water into underground. Risk due to droughts can be reduced by the usage of low water consuming species, reducing the use of exotic species and grass lawns with an efficient irrigation system to reduce water consumption.

6.2. Adapting to stronger storms and flooding

Building design and construction can address flooding in several ways, foremost among them is avoiding flood-prone areas. Raising houses or buildings above the flood

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level is one of the adoptive measures in the areas of floods. Effects due to storms can be avoided by means of plantation.

6.3 Wind-storms and Cyclones

Home with a hip roof and with a central shaft with aerodynamic features can be employed to reduce the wind forces during an extreme wind event and is most suitable in cyclone-prone regions [6]. Collar ties, metal straps and gussets can be used for securing the roof ridge in cyclonic region.

7. CONCLUSIONS: The following are the conclusions that can be drawn:

1. Based on the needs of inhabitants and building users of all ages, care should be taken in designing the buildings and approaches to be adopted based on the climatic condition of the region.
2. Building codes are to be followed while planning and designing the building to reduce the risk.
3. Building orientation should be in such a way that it should reduce the impacts due to rising temperatures and making cooling environment for the buildings located in hot climatic conditions.
4. Sustainable materials are to be used to achieve sustainability.

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