

FOCUS AREA 01

Urban Microclimate

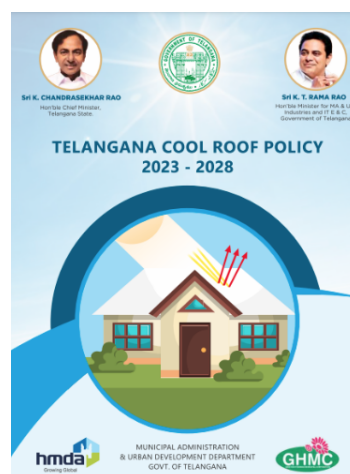
Research and field demonstration for cooler, healthier and more climate-resilient Indian cities.

Cool Roofs

Cool roofs reflect solar radiation and reduce heat absorption in buildings, offering benefits that extend across all sections of society by lowering both indoor and outdoor heat stress. They provide immediate relief to vulnerable and low-income households without access to air conditioning, while large-scale adoption reduces ambient temperatures and heat exposure for outdoor workers such as street vendors and construction laborers. At the city level, cool roofs contribute to energy savings, reduced grid demand and emissions, and enhanced overall urban climate resilience.

Policy

The Cool Roof Policy initiative aims to position cool roof solutions as a mainstream strategy for climate adaptation and heat mitigation across India. IVCCE team is extending technical support for the formulation of cool roof policy in Uttar Pradesh, Andhra Pradesh and Telangana.



Telangana Cool Roof Policy 2023-2028

The broader objective of these efforts is to establish heatwaves as a nationally recognized disaster, thereby enabling stronger policy frameworks, improved resource allocation, and large-scale implementation of heat mitigation strategies across the country.

Roof of Hope

A community initiative called "Roof of Hope" was piloted in Delhi to demonstrate the on-ground impact of cool roof interventions. Under this activity, reflective tarpaulin sheets were installed across 100 homes in an urban poor settlement in West Delhi. The study was implemented with support from the Mahila Housing Trust. Prior to installation, 99% of residents reported their homes as uncomfortably hot during peak summer, whereas after installation, over 95% of households expressed overall satisfaction.



Roof of Hope field implementation in West Delhi

While the pilot initially covered only 100 homes, this summer the initiative was expanded to 1,000 homes with the support of the Nagarro Foundation. The initiative has the potential to be further scaled across the entire community of nearly 4,000 homes in the same colony and subsequently expanded to other urban-poor settlements, paving the way for city-wide replication and strengthening urban heat resilience in vulnerable neighborhoods.

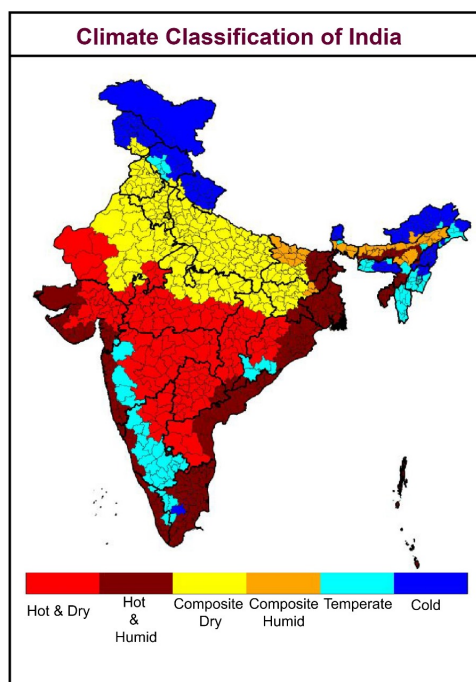


After cool roof installation - roof surface temperature reduced to 48.3 °C, a drop of nearly 20 °C

Climate Zones for Indian Districts

Over the years, with new weather datasets, advanced analytical techniques, and modern building technologies, India needed a fresh, robust, and energy-performance-oriented climate classification. Recognizing this gap, we developed and proposed a new climate classification for India, that reflects current weather patterns, covers the entire nation, and directly connects to building energy performance. For decades, building energy efficiency in India has been guided by codes such as the Energy Conservation Building Code (ECBC), the National Building Code (NBC), and various green building rating systems. However, all these codes and systems have relied on climate classifications that were last developed nearly four decades ago in the late 1980s. Those earlier classifications were based on limited weather station data, covered very few districts, and most importantly were not aligned with energy performance needs of buildings.

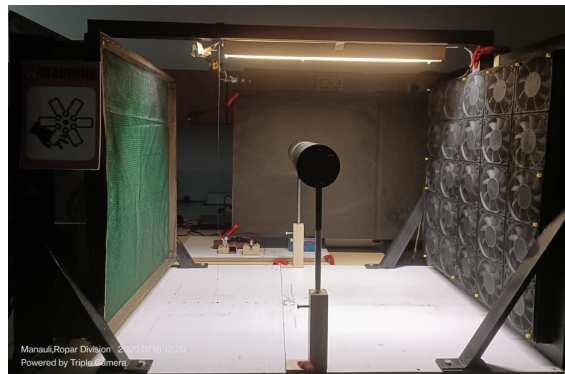
This classification can serve as a foundation for regionalized compliance pathways and baseline performance models, benefiting policymakers and standard-setting bodies such as NBC, ECBC, and green building rating systems. It can also guide architects, engineers, urban planners, and developers, ultimately improving building comfort, reducing energy use, and supporting next generation of energy-efficient, climate-responsive buildings



Proposed Climate Classification of India

Wind Tunnel for Urban Planning

An open environmental wind tunnel has been developed in-house at IVCCE, featuring a 2' x 2' x 2' test section with arrays of variable-speed DC fans on two sides, enabling controlled velocity shear profiles to simulate atmospheric conditions. Compared to conventional single-fan wind tunnels of similar size, this configuration achieves comparable performance with nearly five times lower power consumption, making it significantly more energy-efficient. The facility supports research on urban wind flows, pollutant dispersion, natural ventilation, vegetation aerodynamics, and thermal stratification, positioning it as a valuable tool for urban sustainability, climate research, and environmental engineering.



Wind Tunnel Facility

The wind tunnel facility primarily benefits researchers, faculty, and students at IVCCE, with scope for expansion across the broader Plaksha campus to enable real-world validation and demonstration of airflow, ventilation, and microclimate strategies, ultimately informing urban planning and policy applications.

Urban Mobility

Walkability

As part of its efforts to advance sustainable urban mobility, IVCCE is developing data-driven approaches to assess walkability demand, accessibility, and the condition of street infrastructure. Moving beyond time and resource-intensive manual surveys, the team has created automated pipelines that estimate walkability demand based on land-use patterns and assess existing infrastructure using satellite and street-view imagery. These methods enable city agencies to identify priority locations for pedestrian infrastructure and evaluate its performance across urban areas. The work has expanded to include accessibility assessments in collaboration with the University of Washington, Seattle, and is complemented by city-scale tree-mapping initiatives using computer vision to better understand urban microclimates and walking comfort, with active interest from forest departments in Chandigarh and Delhi.



Geospatial Active Learning

We are using geospatial active learning to speed up the creation of city-scale datasets from satellite and street-view images. Instead of manually labeling every building, tree, road, or water body, a process that is slow and repetitive; Active learning lets the computer identify the most important images that need human input. This makes the annotation process nearly 200% more efficient, enabling us to generate high-quality datasets that support urban projects such as mapping trees, assessing walkability, detecting waterlogging, and planning for climate-resilient cities.

The project primarily benefits scientists and data engineers engaged in developing city-level datasets for urban climate analysis, including buildings, trees, parks, and water bodies. The cloud-based geospatial algorithms are designed for global deployment, enabling city planners, researchers, and policymakers worldwide to access scalable and consistent urban climate data.