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Use of Tools for Study of the Built & Un-Built Environment

LAB for
ENVIRONMENTAL
DESIGN and
SIMULATION
(LEDS)

BNCA Department of
Environmental Architecture
& Planning

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Appraisal in Architecture

- Precedent Building Typology Study

- Site Analysis

- Architects Previous Works

Appraisal of ......

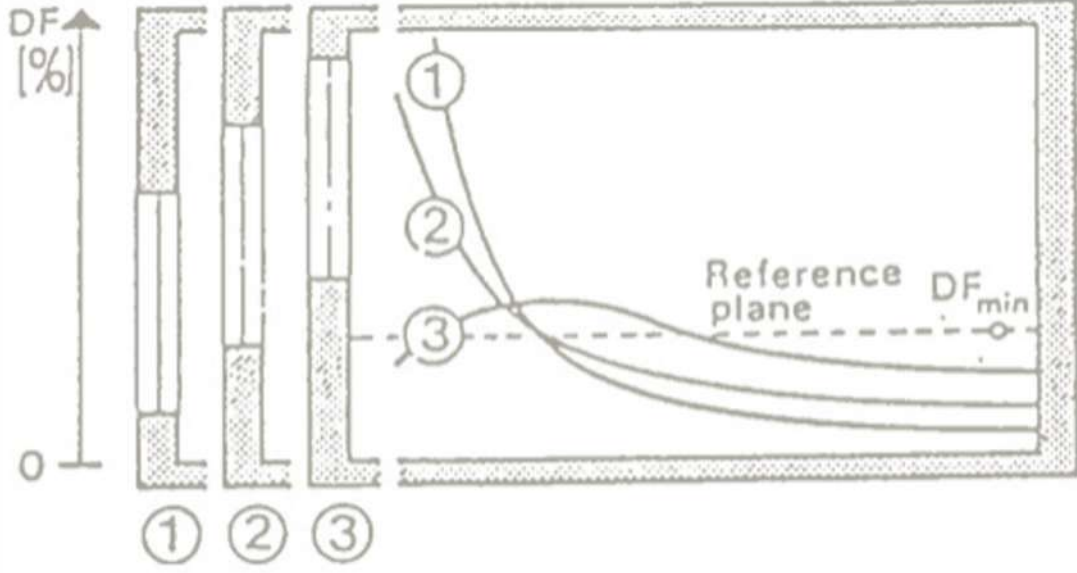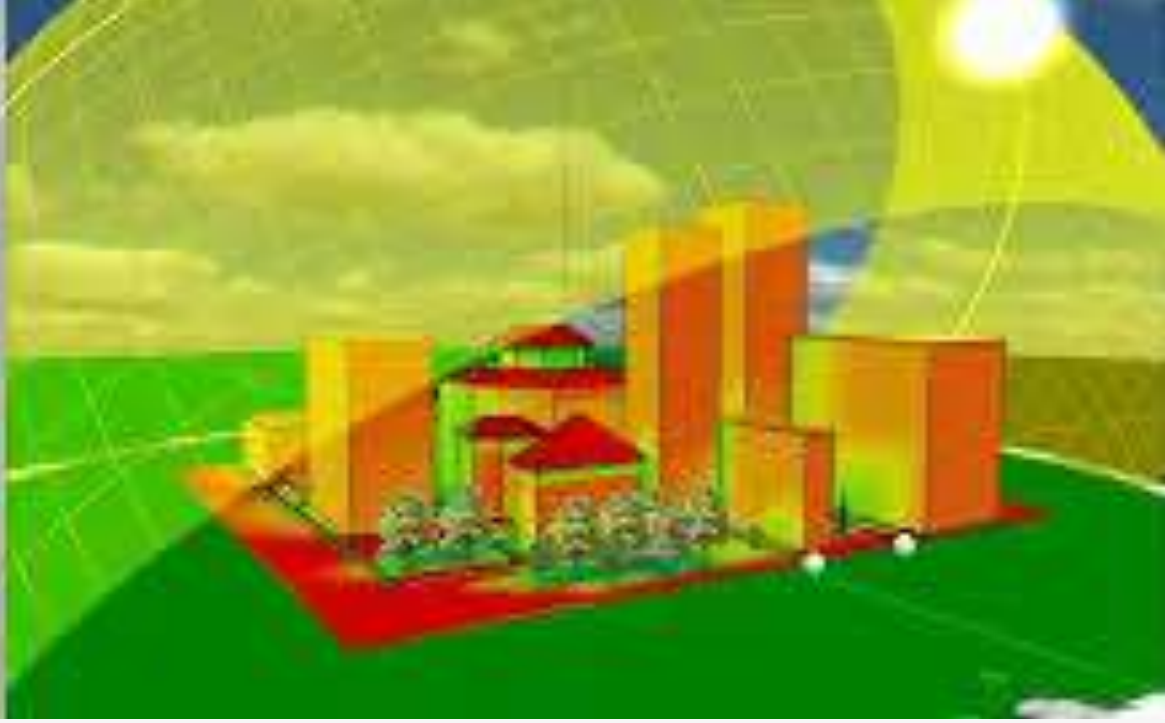Form

Function

Aesthetics

Features / Details

Comfort and Well Being?

So how can you do an **appraisal** for **comfort** and **well being**?

What is Comfort?

An environment that is **comfortable for its occupants/users** in terms of outdoor and indoor thermal comfort (temperature, humidity), indoor air quality (pollutants), visual comfort (light levels), acoustical comfort (noise levels) etc.

How do you do it?

Precedent Studies/ Thumb-rules	Software Performance Tools	Instruments for Measurement
The Effect of Window Height on DF		
Books Calculations Thumb rules Terminologies Key concepts	Simulates the performance of the building Climate Energy Daylight Heat gain etc	Can study through actual onsite field measurements for quantitative analysis of Lighting Noise Pollution Temperature etc

Why Instruments?

- To measure actual on site data

- Real time readings

- Compare with standards and codes

Thermo-hygrometer

What it does?

Measures air temperature and humidity levels indoor and outdoor

How can you use it?

To record the temperature of the space and establish a relationship between indoor and outdoor

Relationship between temperature indoor w.r.t. outdoor

Effect of wind movement on temperature and humidity in the space.

Lux Meter

What it does?

Measure Illumination level in a space and outdoor

Measures both daylight and artificial lighting levels

How can you use it?

- To understand the lighting levels in a space
- To see the effect of different window dimensions and glass types on lighting.
- Lighting in terms of orientation
- Effect of Shading devices and façade detailing on lighting
- Placement of artificial light fixtures and its effect on lighting

Anemometer

What it does?

Measures the wind velocity both indoors and outdoors

How can you use it?

- To record wind speed during site visits for design

- To analyse the movement of wind in a space and its effect due to window sizes, orientation etc

- Effect of site surroundings on site and built form

Surface Thermo-meter

What it does?

Measures the temperature of various surfaces and materials.

How can you use it?

- Can be used to study different building construction materials for its heat gain like glass, stone, brick wall etc.

- The relationship between orientation and materials

Decibel meter

What it does?

Measures the decibel levels in a space.

How can you use it?

- Outdoor noise levels on streets and at different activities and times of the day.

- Noise levels indoors for different activities and compare them with standards.

Thermal Imagining Camera

What it does?

It provides thermographic images of the spaces, buildings and people.

How can you use it?

- To study air leakages in buildings

- To study the temperature differences between materials

- To study temperature differences between indoor and outdoor

- To study human comfort within a space

CO2 Meter

What it does?

Monitors and measures the CO2 levels in an indoor space.

How can you use it?

- To record CO2 levels in a space.

- To study the effect of closed mechanically ventilated spaces as against naturally ventilated spaces

Pollution meter

What it does?

It measures the various indoor and outdoor pollutants

How can you use it?

-   To measure the pollution levels outdoors due to the activities and spaces

-   To measure the indoor pollutant levels due to mechanical systems, furniture, paints etc and its impact on occupants

Other Instruments

- Weather Station

- Voltage meter

- Solar meter

- U-value meter

Use of Tools for Study of the Built & Un-Built Environment

Subjects / Area of Study	Instruments	Remarks
Building Technology & Material	Surface Thermometer Sound meter U-value meter	- You can validate the construction technique & materials. - Example- Rat trap bond, effect of insulation etc
Architectural Design Site Analysis Settlement study Site visits/Case studies	All instruments	- Can be used to study various features and its impact on the design.
Building Services	Lux meter Sound meter CO2 meter	- Can be used to study daylight and artificial lighting features in a space. - Acoustic studies can be done for various spaces - Effect of HVAC system on CO2 levels and its fresh air requirement
HAHS (History)	Surface Thermometer Lux meter	- To study the impact of materials in heritage buildings. - How light contributes to spaces in historic buildings
Landscape Architecture	Thermohygrometer Anemometer Thermal imagining camera	- How vegetation effects the outdoor areas - How a green roof helps in reducing heat gain - How vegetation and other landscape elements effect the wind patterns on site
Research in Architecture	All instruments	- Diverse rage of topics can be selected as per interest

Why Software?
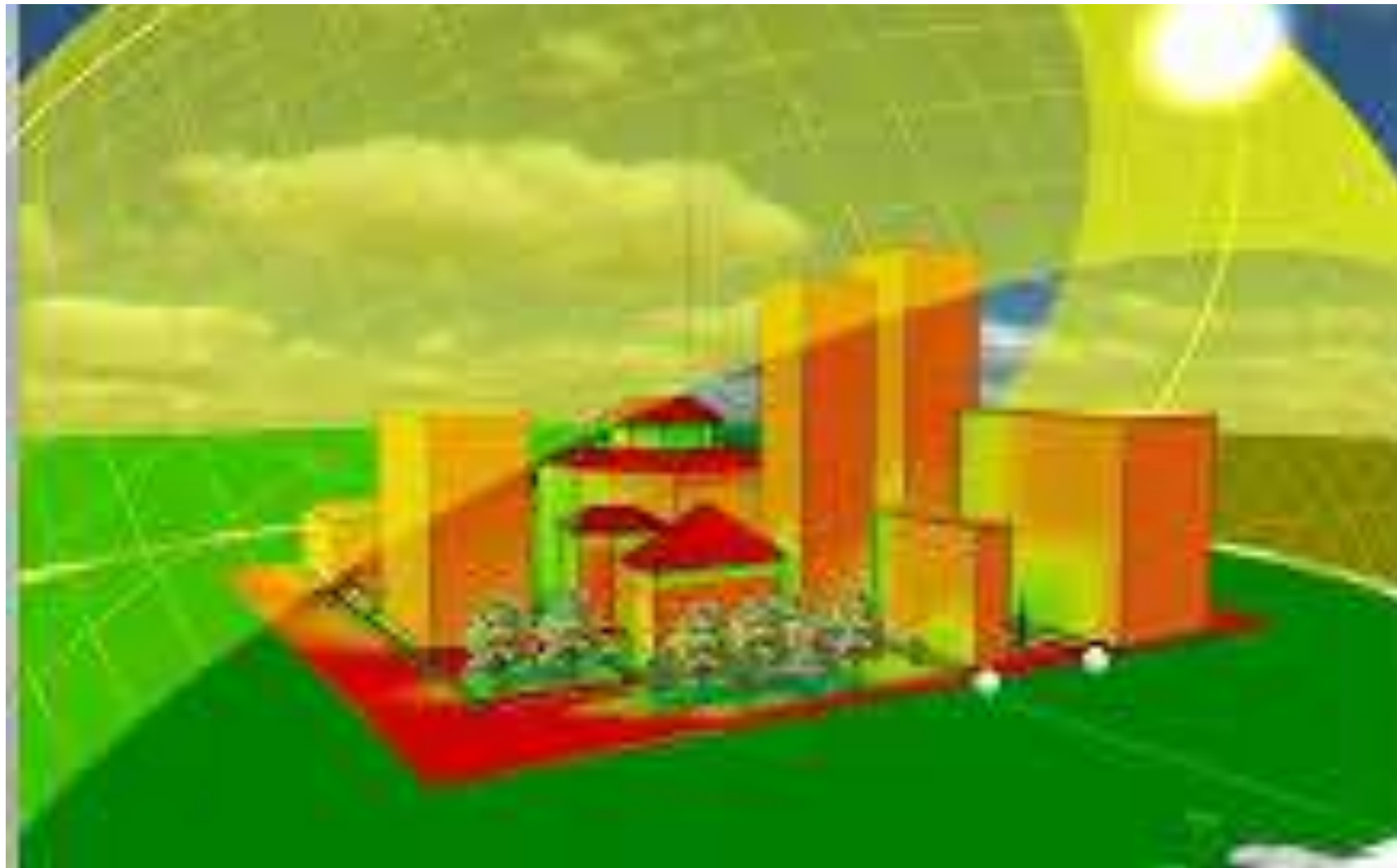

- To study climate of a region/place

- To perform early stage design analysis

- Compare with standards and codes

# Early design Simulation Tool

Climate Consultant

Climate Consultant is a simple to use, graphic-based computer program that helps architects, builders, contractor, homeowners, and students understand their local climate. It uses annual 8760 hour EPW format climate data that is made available at no cost by the Department of Energy for thousands of weather stations around the world. Climate Consultant translates this raw climate data into dozens of meaningful graphic displays.
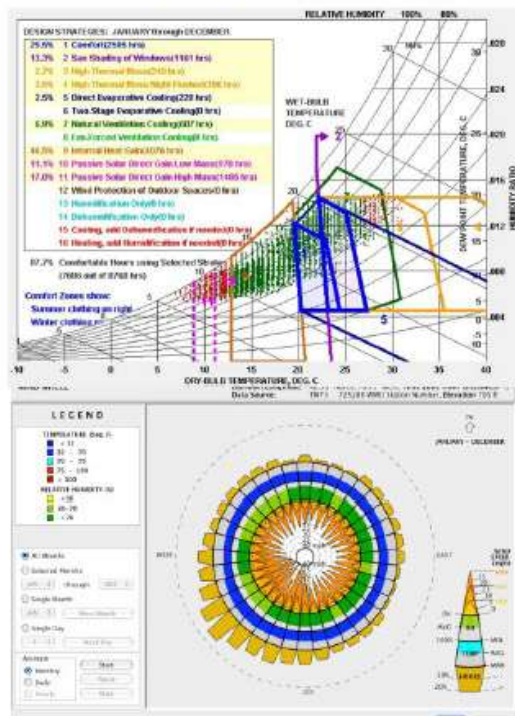
Sefaira

Sefaira Architecture is a collaborative, cloud-based software that combines an engaging, easy-to-learn interface with validated industry-standard analysis engines. It equips firms who care about building performance to:
Produce high-performing design concepts from the early design stages;Collaborate across disciplines and across firms;Educate and empower their teams to adopt Performance-Based Designmarket.
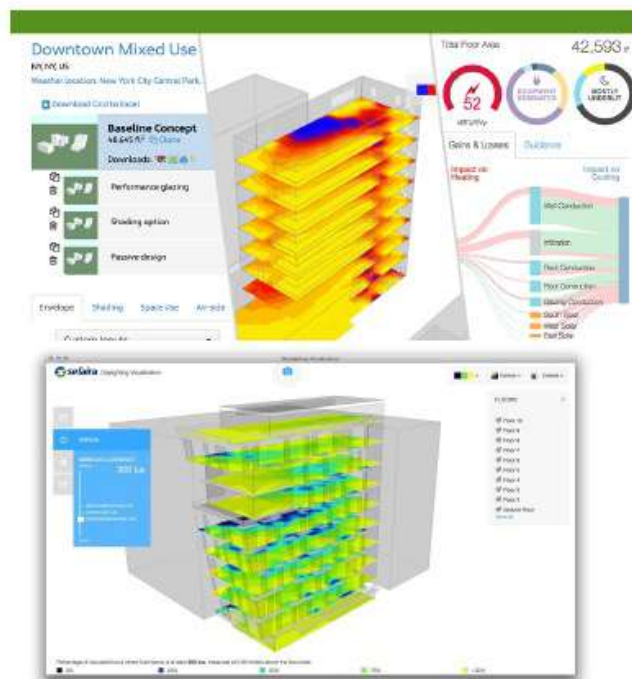

Lighting Tools

Radiance

RADIANCE was designed as a lighting analysis and visualisation aid to Lighting designers, Architects and Lighting engineers for usage in a simulated built environment. RADIANCE accurately calculates the radiance (radiometric equivalent of luminance) in an illuminated space.
It is commonly used to analyse and predict light levels and for visualisation prior to construction.
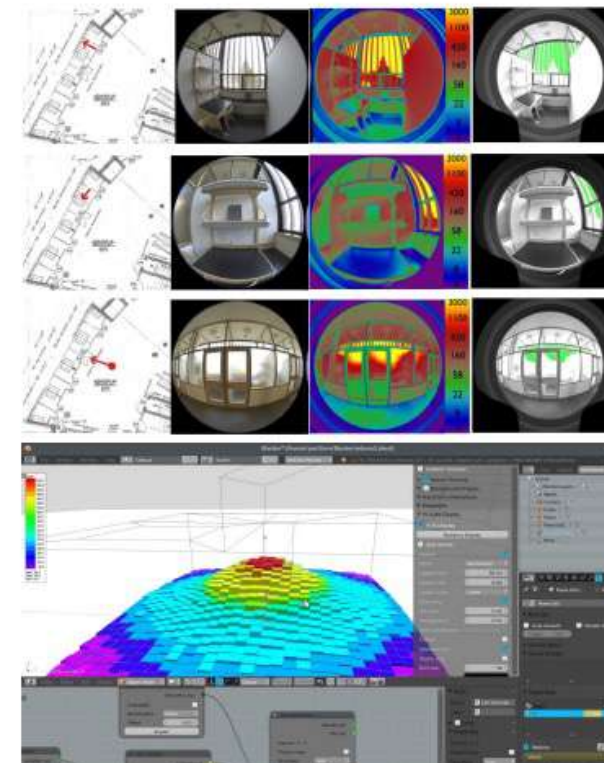
Dialux

With this free software you can design, calculate and visualize light professionally – single rooms, whole floors, buildings and outdoor scenes. You can plan and design using the electronic luminaire catalogues of the world's leading luminaire manufacturers.

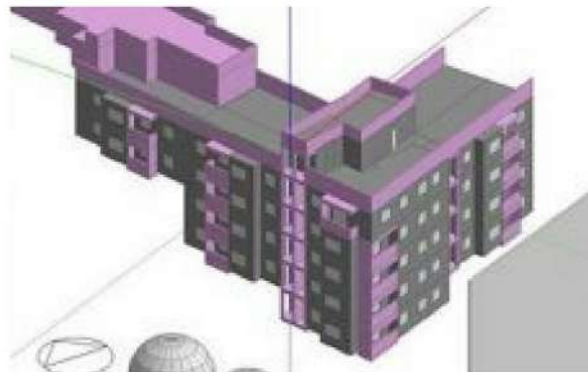Superimpose on the CAD data of other architectural programmes and create your own lighting design.
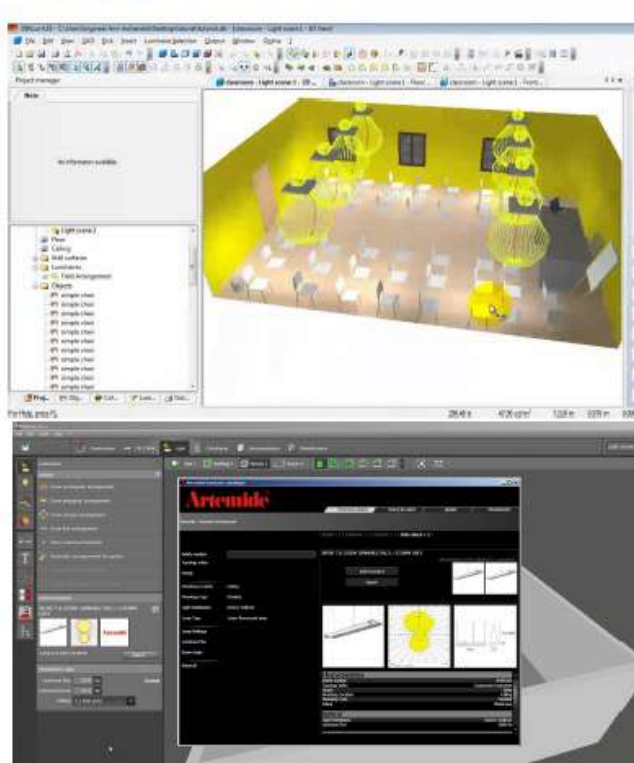
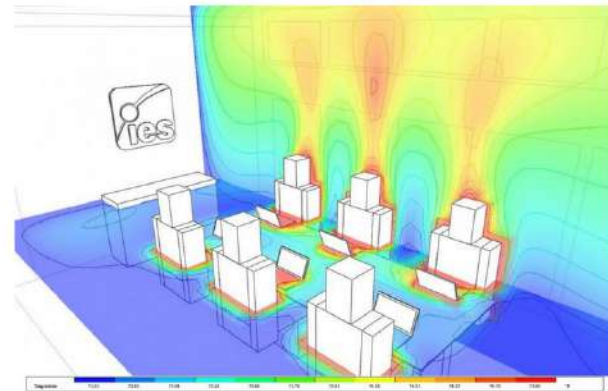# Whole Building Performance

Planning Tool

Design Builder

DesignBuilder is a whole building simulation software.It enables the design team to use the software to develop comfortable and energy-efficient building designs from concept through to completion.

IES

IES helps you deliver ambitious performance goals while seeking opportunities to keep costs appropriate. With advanced IES-VE tools you can perform daylight and energy modelling along with CFD analysis.

Equest

This is a freeware software and perform complete detail building energy performance and modelling. It has a robust backend engine of energy plus with full HVAC compatibility.
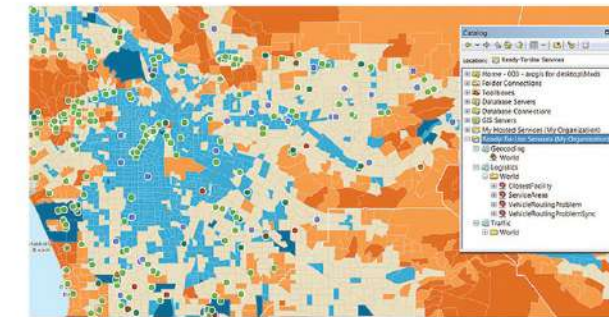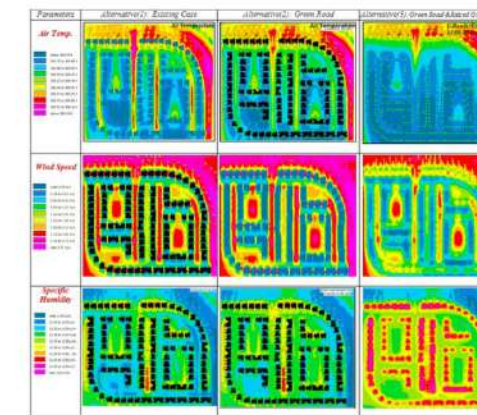

eQUEST Model

ArcGIS

A geographic information system (GIS) facilitates the collection, analysis, and reporting of spatial data and related phenomena. ArcGIS is this platform to organize, create, manage, share, and analyze spatial data.
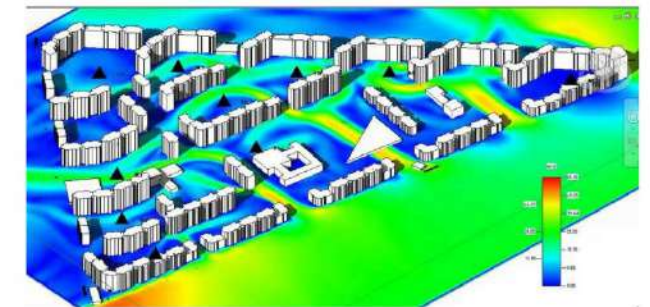

Flow design

Flow Design is virtual wind tunnel software used to model airflow around building blocks at urban level. It models wind behavior around an exterior and provides an understanding of where there may be risks of elevated wind speeds or where there may be stagnant areas that affect air quality or comfort.

Envi-Met

ENVI_MET is a holistic three-dimensional non-hydrostatic model for the simulation of surface-plant-air interactions not only limited to, but very often used to simulate urban environments and to asses the effects of green architecture visions. It is designed microscale analysis. This allows to analyze small-scale interactions between individual buildings, surfaces and plants.

Working Models

- To study the working of various systems

- To test the application with actual materials

Use of Tools for Study of the Built & Un-Built Environment

Radiant Cooling System

IDEC System

Structure Cooling

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