SUSTAINABILITY STRATEGIES IN BUILDING DESIGN

CASE STUDIES
GRIHA Summit: Mar 12, 2015

SUSTAINABILITY...
LOOK BACK TO MOVE AHEAD
Combining Nature (Passive) with Systems (Active)

Summers: Mar to Jun
Predominant Wind: From North-West

Monsoon: Jul to Oct
Predominant Wind: From North

Monsoon: Jul to Oct
Predominant Wind: From West

Building Plan with Superimposed Annual Predominant Wind Direction Analysis: From North-West

Climatic Analysis
Site CFD Analysis

- Wind Velocity at Pedestrian Level ~ 2 m/s (Comfortable)
- Wind Flow Through Courtyard ~ 0.5 m/s – 2.5 m/s (Controlled & Comfortable)
- Wind Flow in Open Area at Building Front & Back ~ 0.5 m/s – 1 m/s (Poor Ventilation & Uncomfortable)

Building Courtyard Analysis
Glare Analysis

Plan View – Glare Extent on Floor From Each Facade

Glare Analysis in Office Premises

- Ingress Via South-East Windows @9am
- Ingress Via South-East Windows @10am
- Ingress Via South-West Windows @3pm
- Ingress Via North-West Windows @5pm
The analysis is done at 12pm considering clear sky condition.

- Wall: Surface reflectance of 65%
- Floors: Surface reflectance of 50%
- Ceiling Paints with surface reflectance of 85%
- North/South/West/East Glazing: Visible light transmittance 49%

Building achieves 270lux in 61% areas.
SITE MASTER PLANNING
(MIXED USE DEVELOPMENT AT DELHI)

- ENHANCED MICROCLIMATE
- HEAT ISLAND REDUCTION
- ENHANCED PEDESTRIAN THERMAL COMFORT

Focus Areas Of Analysis

OUTDOOR SEATING  CENTRAL PLAZA  STREET
Direct Solar Radiation Analysis

Low Solar Radiation
On North East & North West Walls
High Solar Radiation
On roof

Solar Shading Analysis

SUMMER SOLSTICE
(21st June, 9AM-6PM)
Preferred Location for Pedestrian Seating/Movement/Activities

EQUINOX
(21st September, 9AM-6PM)

WINTER SOLSTICE
(21st December, 9AM-5PM)
Recommended Strategies

Shading Structures For Seating Area/ Pedestrian Activities

Light Colored Paving/Vegetation

Wind CFD Analysis

WIND DIRECTION: NORTH-WEST
AVERAGE WIND VELOCITY: 2 m/s
Recommended Strategies

Water Features For Central Open Space
Water Fountain, Mistifiers Etc Provide Evaporative Cooling For Open Spaces

Recommended Strategies

Water Features For Open Space Of Existing Mall
Ground Embedded Water Runners For Paved Area

These Will Absorb Heat From Paved Surface On Ground & Enhance Thermal Comfort

Site Water Feature / Cooling Tower For Evaporative Cooling

Light Color Paving (SRI ~ 30)

Water Runners @ 600 mm C/C

Water Runners Embedded in Ground

Recommended Strategies

Gas Heaters For Heating Winter Winds
**Recommended Strategies**

**Cooling Strategies:**
- Evaporative Cooling
- Radiant Cooling using Runners

**Recommended Strategies In Critical Areas**

**OUTDOOR SEATING**
**Cooling Strategies:**
- Shading
- Evaporative Cooling using Mystifiers

**CENTRAL PLAZA**
**Cooling Strategies:**
- Evaporative Cooling
- Radiant Cooling using Runners

**STREET**
**Cooling Strategies:**
- Evaporative Cooling
- Partial Shading
- Radiant Cooling using Runners
Roof Design

Recommended Strategies

- Relocate Restaurant
  Relocating restaurant towards SE & introduce terrace garden on the NW

- Propose Terrace Gardens & Water Bodies
Recommended Strategies

Introduce Garden & Water Bodies On Roof.

• Cool Dry Summer & Mid-season Wind For Terrace Users
• Reduce The Heat Island Effect On Roof
• Reduced Heat Load of The Building

ENHANCED MICRO-CLIMATE:
IMPACT ON ENERGY CONSUMPTION OF BUILDING
Macro Climate Vs Micro Climate

Enhanced Micro-Climate Will Impact G.F. & F.F.

ENERGY SAVINGS

SAVINGS
Peak Envelope Load: 1.95%
Total Annual Energy Consump.: 1.65%

1.65% Savings Through Enhanced Micro-Climate
PET ANALYSIS FOR VERIFICATION OF OUTDOOR THERMAL COMFORT

Outdoor Thermal Comfort Analysis

• PET – Physiological Equivalent Temperature

Universal index for assessment of outdoor thermal comfort

energy exchange between the human body and the urban environment
PET ANALYSIS

ENVIRONMENTAL PARAMETERS

• Air temperature
• Relative Humidity
• Wind velocity
• Cloud Cover
• Global radiation
• Mean Radiant Temperature

PHYSICAL PARAMETERS

• Clothing
• Activity (MET)

Conclusion

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Passive + Active

Sustainability

Integration of Passive & Active Strategies

Leads to Net Zero
“Net Zero”
The Next Wave Of Green Buildings

Our “Net- Zero” Experience

ECO COMMERCIAL BUILDING
- First Net Positive Energy building of India
- LEED-India Platinum Rated building
- Awarded with ASHRAE Technology Award

INDIRA PARYAVARAN BHAWAN
- Largest Net Positive Energy building in Asia
- GRIHA 5 Star rated building
- LEED-India Platinum Rated building

SHUNYA
- First Net Zero Energy Home of India
Even little things make difference in getting to zero

(as you get to zero, small items become significant)

Quantification of Impact of these little things is important!
leave the earth better than when we started for existence and enrichment of our future generations...

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