SITE PLANNING FOR ARCHITECTURAL PROJECTS

Ar. J.K.GUPTA, Former Director, College of Architecture, IET Bhaddal--
Email---- jit.kumar1944@gmail.com

Buildings- Role and Importance

- Buildings-- integral part of human history, growth and development
- Buildings -- shall continue to define journey of human growth and development
- Buildings-- make manmade environment- vital for human growth
- Buildings –are living organism
- Buildings -- as structures cater to all human activities
- Buildings -- largest consumers of energy (50%)
- Buildings - largest consumers of resources
- Buildings – largest generators of waste
- Buildings- largest polluter of environment /ecology
- Buildings --- responsible for largest carbon footprints
- Buildings -- responsible for global warming
- Buildings -- major determinant of global sustainability

Buildings- Role and Importance

- Buildings– providers of optimum/worst living conditions
- Buildings -- make people healthy/sick
- Buildings --critical because 80% human life spent in buildings
- -- Buildings-- vital to address / overcome human/ ecological concerns
- Making Buildings Sustainable-- essential to make value addition to resources, environment ,ecology
- Studies revealed —

  Sustainable school Buildings-- makes learning easy and more meaningful
- Sustainable Home --- makes people happy and healthy
- Sustainable Hospital building-- cures patients quickly
- Sustainable shopping mall-- can increase sale / profits

SDG 11- Make cities and human settlements inclusive ,safe, resilient and sustainable


WORLD GREEN BUILDING COUNCIL
SUSTAINABLE DEVELOPMENT GOALS
Green buildings can improve people's health & wellbeing
Green buildings can use renewable energy, becoming cheaper to run
Building green infrastructure creates jobs & boosts the economy
Green building design can spur innovation & contribute to climate resilient infrastructure
Green buildings are the fabric of sustainable communities & cities
Green buildings use 'circular' principles, where resources aren't wasted
Green buildings produce fewer emissions, helping to combat climate change
Green buildings can improve biodiversity, save water resources & help to protect forests
Through building green we create strong, global partnerships
3 GOOD HEALTH AND WELL-BEING
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
15 LIFE ON LAND
17 PARTNERSHIPS FOR THE GOALS

- **Designing Green Buildings**

Buildings- Built Environment

- Operational domain of Buildings revolves around:
- -Searching for a Site
- - Site Planning
- -- Designing Building
- --construction,
- --operation,
- -- maintenance
- --Demolition and
- -Reconstruction of building
- Professionals-- have a critical role and responsibility in;

-- Making value addition to resources ,environment ,ecology

-- creating sustainable buildings.

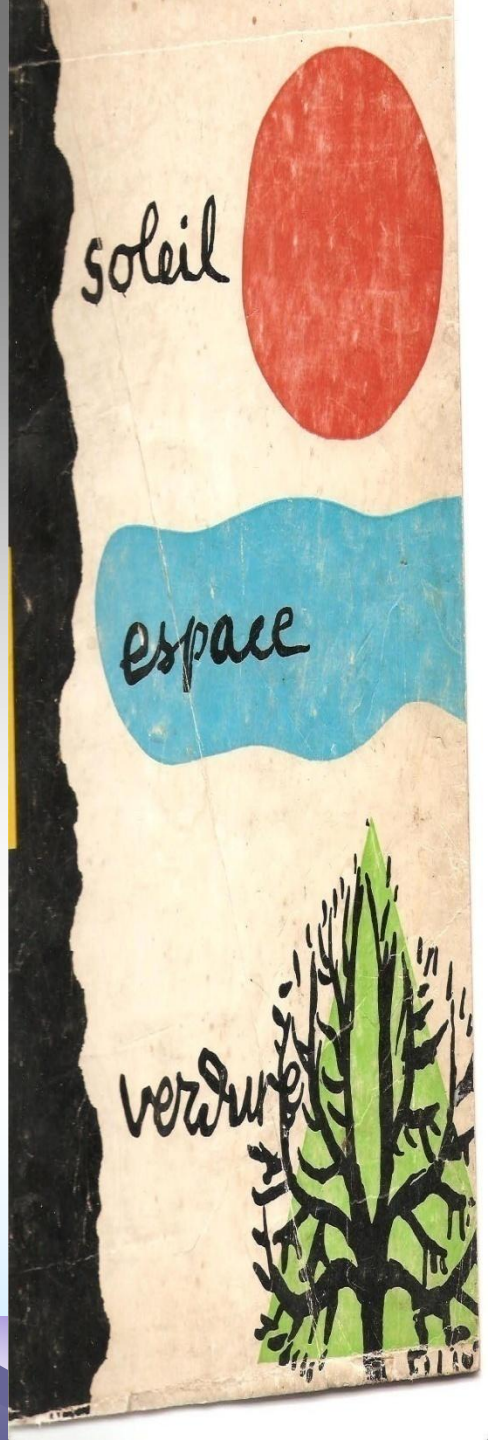
- -- Making Buildings cost–effective

-- Making optimum use of available resources

--- Using the existing potential of site

DESIGNING GREEN BUILDINGS

- **Adopting integrated approach to building design for reducing energy in buildings by:**
  - **Site planning-** planning with nature, making best use of site potential/climate, orientation, landscaping
  - **building envelop design –** with minimum energy implications
  - **High building efficiency-**
  - **Integrating renewable energy resources-** to generate energy on site.
  - Using **Ecologically sustainable/ low energy materials- local and in natural form**.
  - Using **eco- friendly construction methodologies**.
  - Effective **water and waste management**.
  - Innovative options used **for heating, cooling, lighting and ventilation.**
- Role of **Architects, Engineers, Structural Engineers, Builders critical in evolving Energy Efficient buildings**.
- **Town Planners** to contribute to energy reduction by :
  - **–evolving layout plans with energy as focus,**
  - **–making best use of sun and wind**



Designing Green Buildings

- Green Building Design to be based on - CLIMATE
- Orientation -- to optimize light and heat gain/heat loss
- Sun movement-- to maximizes use of free solar energy for heating /lighting
- Wind direction---using movement of air for ventilation/ cooling
- Planning -- to optimize the site, shape of building, planning spaces, allocating uses, placing or rooms, circulation, promoting building efficiency, promoting natural sunlight, air and ventilation
- Building Envelop--– Mass – space relationships/ solids and voids, positioning of openings ,projections, shading devices, height, shape of building, natural lighting and ventilations etc
- Materials- Materials to be used for buildings- low embodied materials locally available and in natural form, lightweight – reduce dead load
- Technologies - Cost- effective, material efficient, speedier construction, energy efficient
- Indoor Air Quality- To create optimum living conditions for residents

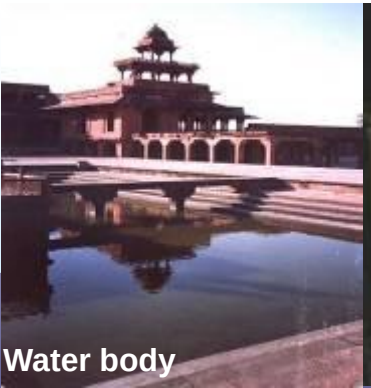
Designing Green Buildings

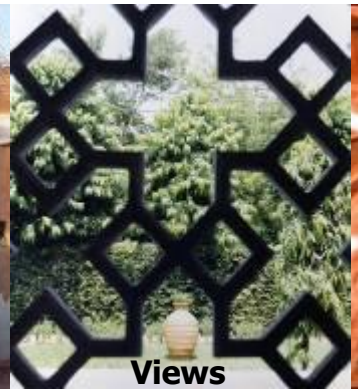
- **CLIMATE to be the major driver of the Green Building Design**
- **Climate to be considered in three contexts**
- **Macro Climate - Regional context- to help understand the prevailing general climatic conditions & climatic zone in which site falls**
- **Meso Climate – Settlement context- to understand the prevailing local climatic conditions**
- **Micro Climate--Site climate – to understand the site and site specific peculiarities in terms of location, topography, existing flora/fauna/ water bodies etc**

Indian Way of approaching design

- Rediscovery of the Indian ethos
  - We worship 5 elements of Nature (Panchabhutas)

Prithvi (Earth)	**Sustainable Sites**
Jal (Water)	**Water Efficiency**
Agni (Energy)	**Energy Efficiency**
Vayu (Air)	**Indoor Environmental Quality**
Akash (Sky)	**Daylight**





- Context of Site
- In Designing Buildings

Understanding Site

- **Understanding Site critical for**
- **Defining structure of the project**
- **Positioning Buildings**
- **Determining solid and void relationship within site**
- **Determining** shape, size &volume of buildings
- **Determining** distances between buildings
- **Planning and designing** state of art Buildings;
- **Planning and designing** Sustainable Buildings
- - Creating Cost –effective Buildings
- -- Planning of spaces- both internal and external
- -- Determining building setbacks
- - Preparing Landscape design
- - Evolving Traffic and Transportation Plan
- -- Preparing Infrastructure plan
- -- Evolving Service Plan - Preparing Drainage Plan
- - Providing Rain water Harvesting

Understanding Site

- **Before starting design;**
- -- site needs to be studied, analysed and understood thoroughly and objectively
- --Design to be outcome of the site and site responsive
- - Premeditated design always fail to do justice to project- making them irrational/unsustainable
- -- SWOT analysis of Site needs to be carried out- to understand its strength, weaknesses, opportunities and threats
- -- Design to aim at making optimum use of strength of site
- -- overcome its weaknesses
- -- make best use of opportunities being offered and
- -- ward off all possible threats
- Site needs to be looked out both from inside, outside and from top and bottom

Understanding Site

- Site needs study/analysis in terms of;
- **Location,**
- **Accessibility**
- **Shape and size**
- **Topography,**
- **Vegetation,**
- **Infrastructure,**
- **Orientation**
- **Wind Direction**
- **Local culture, soil conditions**
- **View from site /View to site**
- **Prevailing typology of buildings**
- **Existing structures within site**
- **Existing encumbrances- electric /gas lines, water bodies etc**
- **Local Building bye laws**
- **Developmental Controls- Height, FAR, Setbacks ,land use etc**
- **Restrictions imposed by Master Plans/ statutory document**

- **Site Analysis**

Site Analysis

Thorough and objective site analysis critical for evolving cost-effective, environmentally sustainable and rational design solution for any project

Site analysis critical for evaluation of site in terms of ;

- Its existing potential
- Understanding environmental impact of development
- Impact on community
- Impact on adjoining development/properties
- defining project design
- - defining scope of project
- - understanding development constraints

Site Analysis- Factors considered

i) Understanding Site
ii) Location
iii) Orientation
iv) Wind direction
v) Soil conditions
vi) Topography
vii) Vegetation and Natural Features
viii) Hydrology and Precipitation
ix) Infrastructures
x) Surrounding Land uses & Buildings
xi) Vision / Visual Linkages

Site Analysis- Location

i) **Understanding Site –**

- most critical in design process

•. Detailed site analysis needed to--

- Record

--Evaluate information on the site and its surroundings --

--understand the various features which will be important during the design

ii)**Location**

First aspect that one needs to look at----

- Where is the site located?
- How is the site approached?
- What is street/ road etc on which site is located?
- How far away major junction?

•-- Respect the abutting roads to site

•- Position buildings parallel to abutting roads even when site not regular

Orientation-- Movement of Sun and planning of building

Site Analysis- Orientation

iii)Orientation is position/positioning of site with relation to points of compass/other specific directions

- **Context of each cardinal direction needs to be understood- North/South/East/West**
- Context of Climate zone needs understanding for design
- Orientation plays important **role in siting building.**

When combined with:

- -- wind direction and
- -- sun path

would give a good idea as to how building / design should be oriented so as to :

--optimize design.

- Orientation- along with sun path will determine **placement of rooms** inside buildings.

Site Analysis- Orientation

- South- East --best orientation in composite climate
- North -- worst orientation in cold/ hilly areas- North slope to be banned for all development in hills
- North orientation- best for sourcing glare free , uniform natural light without any heat gain- provide opportunities for large glazing- most suitable in industrial buildings
- West – worst orientation- Minimum surfaces to be provided in west to avoid heat gain- have minimum west oriented walls, where provided—use cavity walls/thick walls/green walls/ventilated cavity walls/white paints/reflective surfaces/ trees for shading vertical /louver-- provide minimum openings- use for storage/ non-habitable uses
- West/South west--Residential Buildings- can be used for morning sit out spaces

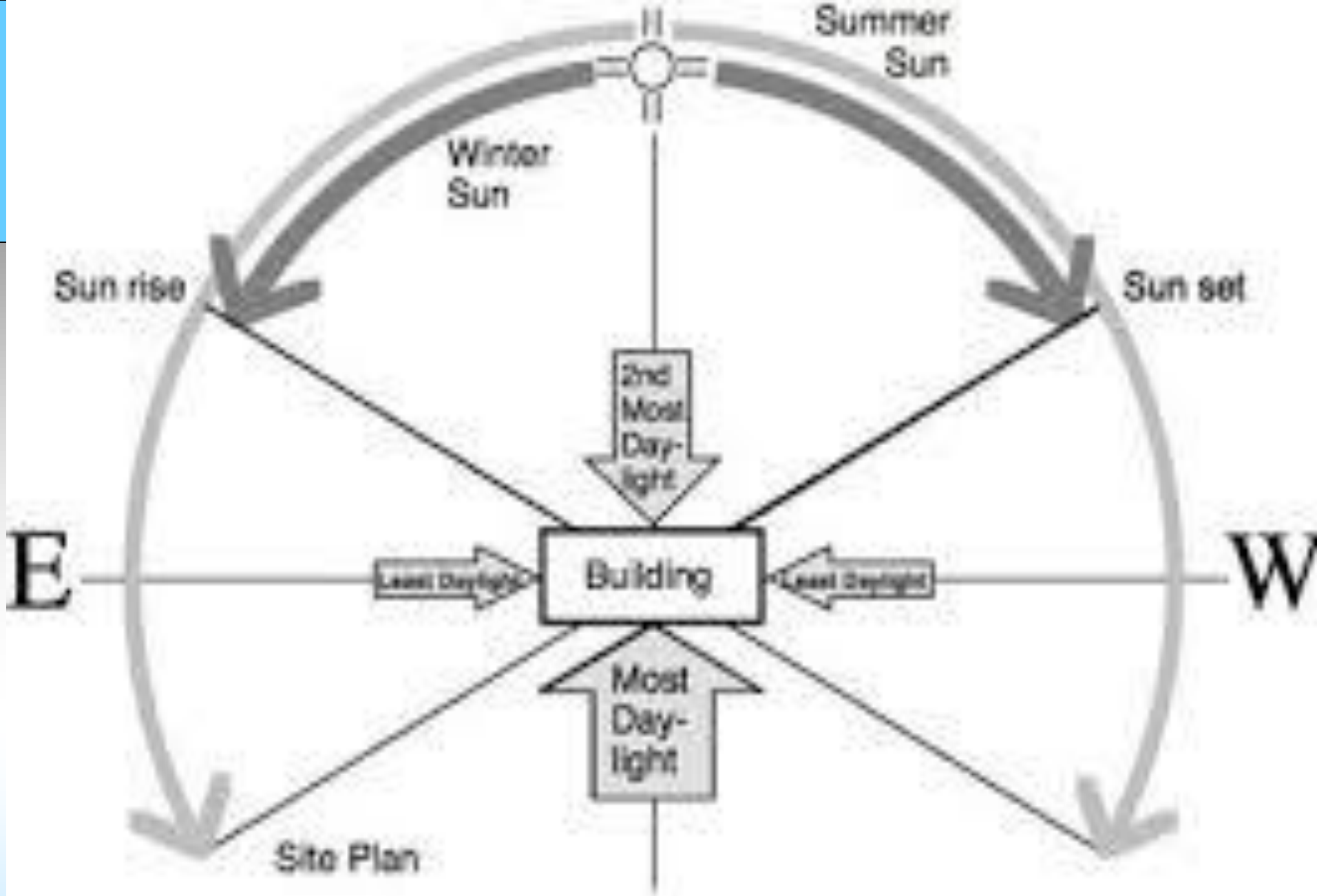
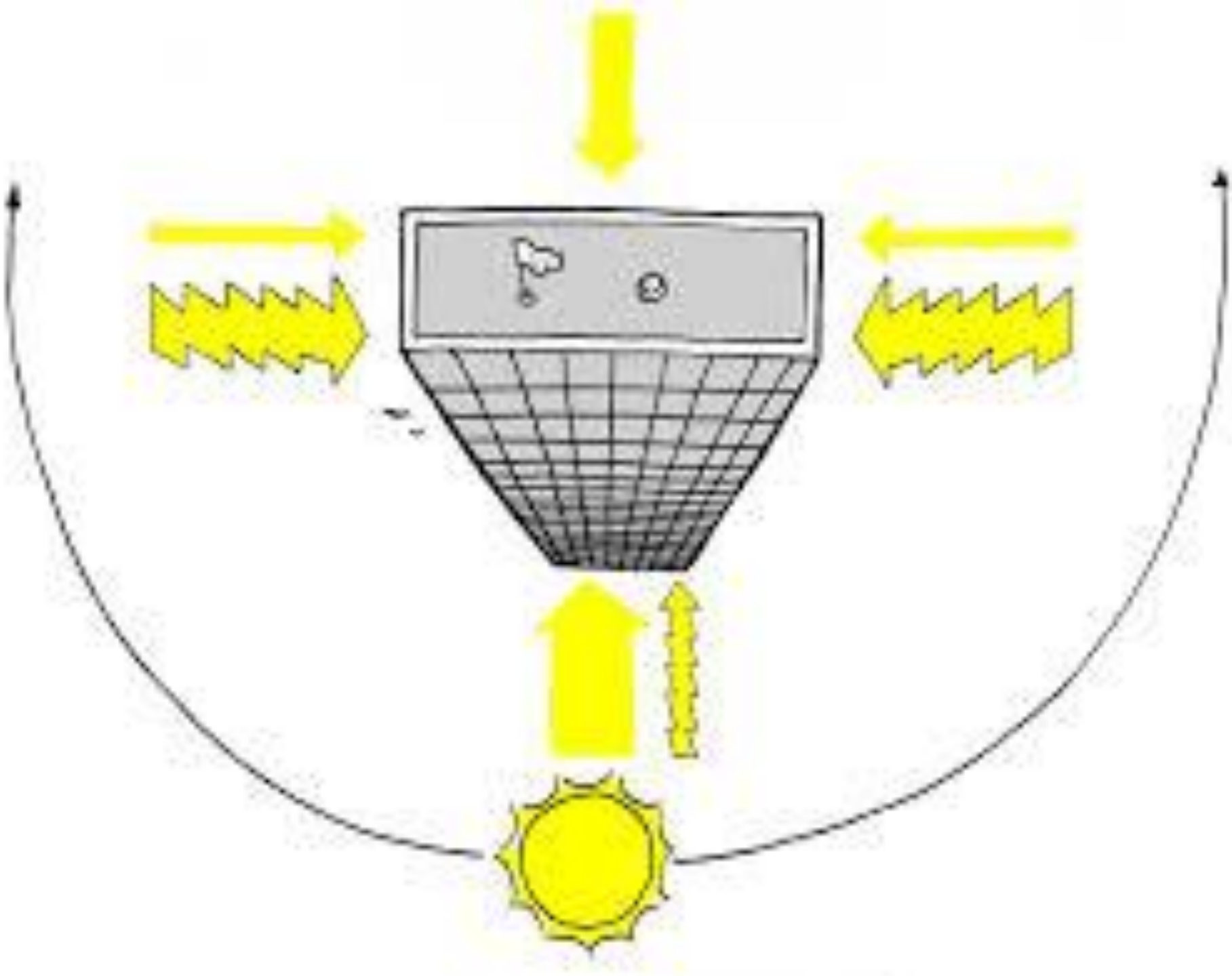
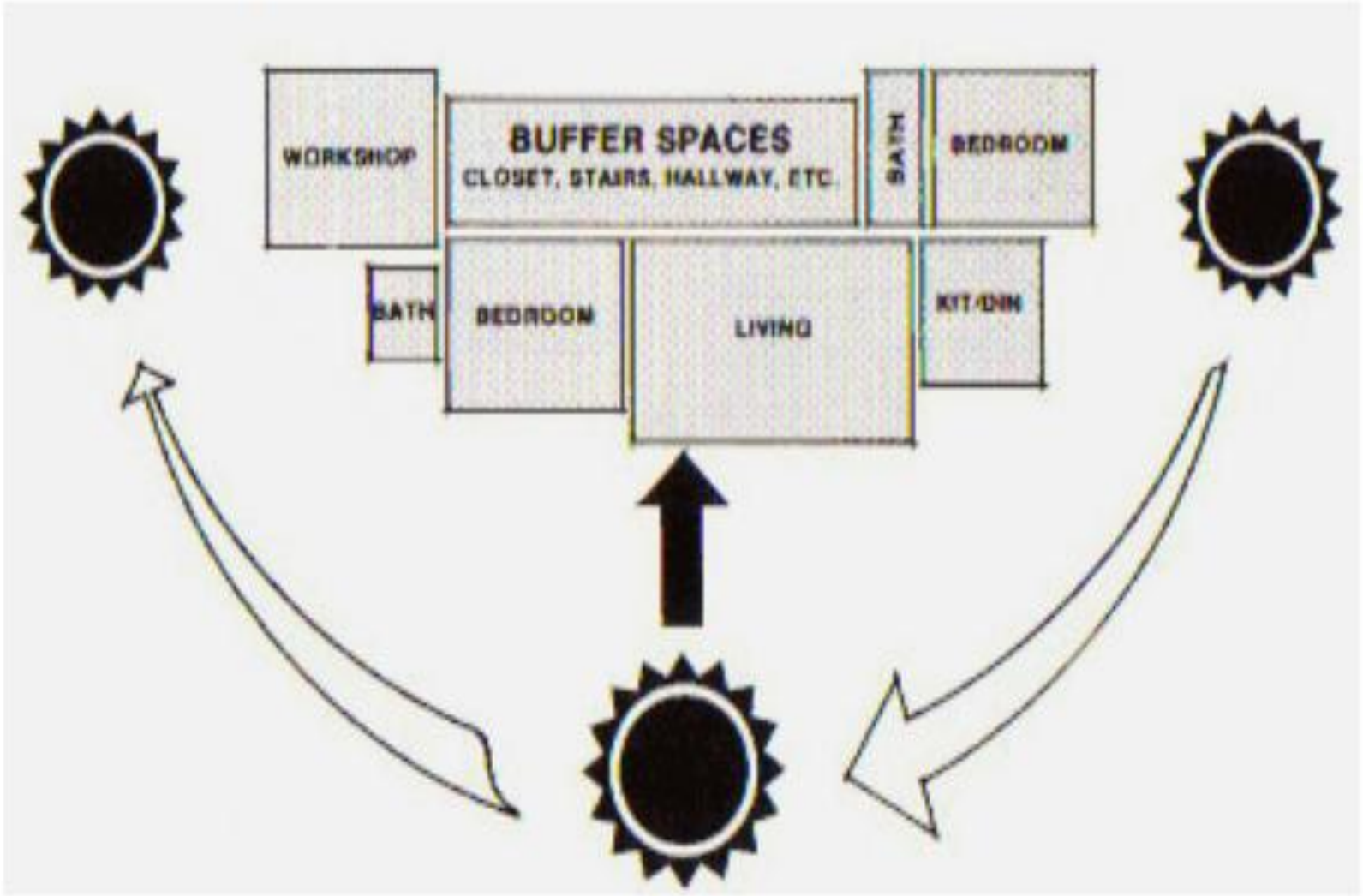

Summer Sun
Winter Sun
Sun rise
Sun set
2nd Most Day-light
E
Least Daylight
Building
Least Daylight
W
Most Day-light
Site Plan

Figure 1



Making Buildings Energy efficient

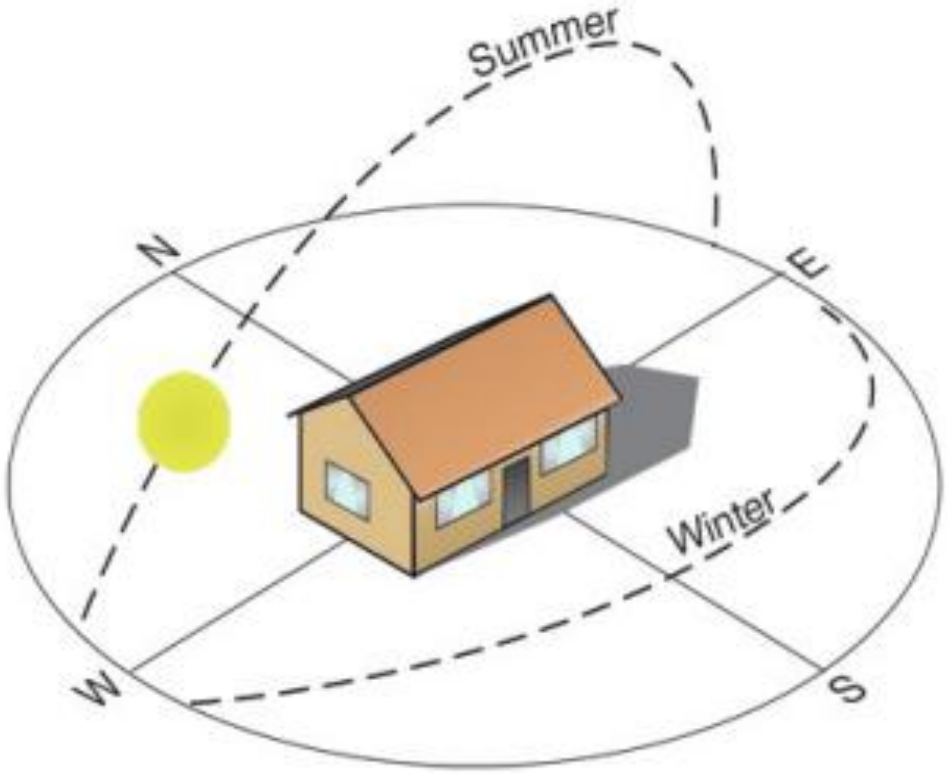


Building Orientation

from the summer sun.

5. Building Orientation and Shading

5.1 The building shall be oriented with the long sides facing north and south whenever the site and location permit such orientation.



5.2 Balconies and open terraces should be built on the south side of the house, where

Site Analysis- Wind Direction

iv) Wind Direction

---Most locations

-- will have a general major direction from which wind comes.

-- However, not always hold true

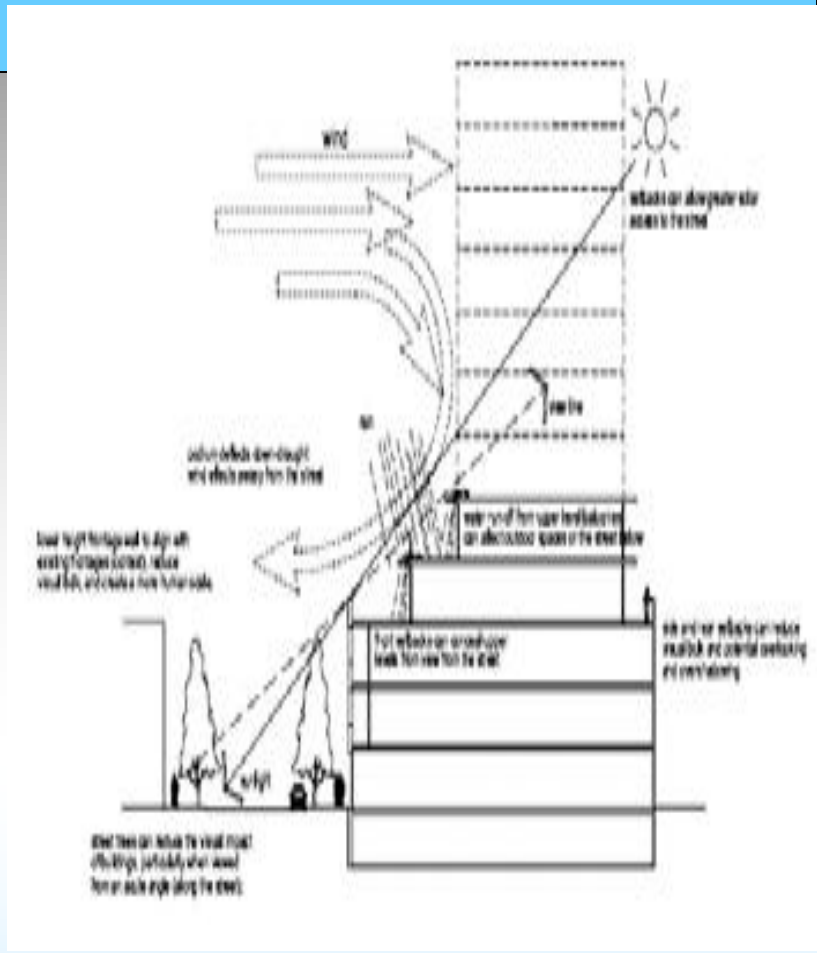
-- varies from location to location

-- season to season.

• For designing a climatologically responsive building --important to consider

-- direction of wind

-- to channelized through interiors.



Site Analysis-Soil Conditions

vi) SOIL

Soil varies from place to place.

- **Properties also vary according to type of soil.**

-Sandy soil,

- clayey soil,

--laterite etc

all have different properties–

-- load bearing,

-- water retentivity

--Water absorption

-- homogeneity

-- which impact design of building.

-- Soil conditions important -- while designing structure of buildings.

Site Analysis-Topography

vii) Topography –
--refers to the slope and level of land whether;
--- land is flat/plain or
--- sloping/ undulating

- **Designing--a sloping site more challengin**
- **If a site is sloping, exact slope can be interpreted from a detailed Contour map.**
- **Locations and spacing of contour play a**
- **big role in siting of building.**
- **Always better to design buildings along contours,**
- **integrating contours into design reduces unnecessary cutting and filling of soil.**

Site Analysis-Vegetation & Natural Features

- **Viii) Vegetation and Natural Features**
- **Natural vegetation present on site -- very important.**
- **Every good design will**

-- integrate
---highlight &
---accentuate
Natural vegetation to create perfect harmony.

- **Vegetation comprises of-- trees, flora and fauna existing on site.**
- **Marked on site plan to integrate with design along with by defining their;**

--location, ---
-- type ,
-- size ,
--diameter or
- spread of branches/ heights etc

Vegetation and Natural Features

Site Analysis-Precipitation & Hydrology

ix) Hydrlogy and Precipitation:

•Amount of rainfall and

• Time period during which rainfall occurs/ site receives ---are to be found out.

• Relative Humidity found out to --determine moisture content in atmosphere.

• Higher relative humidity suggests a humid climate,-- cross circulation of wind at body level is a must for comfort.

• A lower relative humidity suggest s a dry climate

Site Analysis- Infrastructure Facilities

x) Infrastructure

•Infrastructure facilities refer to services present in vicinity of Site.

• Major facilities to be considered are :

-- water supply,

-- Storm water drainage ,

-- Waste disposal,

-- Electricity supply

- Roads

-Communication network etc.

• Important while planning / zoning site for :

--promoting economy and

--making optimum use of services

Site Analysis-Land Use/Visual linkages

xi)Surrounding land uses & buildings –

. For optimum design solution —

--surrounding land uses and

--buildings

.need close focus and consideration

• Incompatible landuses may lead to creation of issues in design.

•Height and setbacks of adjoining buildings important in ensuring

•--flow of air and

--- sunlight.

xii) Prominent Vision lines / Visual linkages –

•Important element in design process.

• Views to site as well

•-- views from the site

•-- need careful consideration,

•-- while designing.

Site Planning

Site Planning-definitions

Site planning is the;

– Art and science of positioning structures and designing internal and external in a given site.

- --It is also the Art and science of determining typology of buildings and their location in the context of a given site having regard to orientation , landscaping, infrastructure, mobility, parking , privacy, view etc
- Art of arranging structures on the land and shaping spaces between
- An art linked to architecture, engineering, landscaping and city planning- Kelvin Lynch- site planning 1984
- Relation between Mass, space, zoning , services & maintenance

Site Planning-definitions

- Art and science of arranging structures on land and shaping spaces between buildings
- Art of arranging uses of land linked to architecture, engineering, landscape and city planning
- Locating activities and objects in space and time
- Compromise between the site modified to work with site and building program taking into account features of site
- Art and science to blend the requirements of the site with the least damage to land and surroundings
- Art of planning and designing or management of land
- Arrangement of natural and manmade elements through application of the cultural, scientific knowledge focusing on resource conservation
- Art of arranging structures on the land and shaping spaces between them

Site Planning

- Site Planning involves;
- - Buildings
- -- Roads
- - walkways
- - Trees
- -Gardens
- --Water bodies
- -- Landscaping
- - Plaza
- --Environment
- -- Services
- --Parking
- - natural and manmade features etc

Site Planning- Elements

Elements of Site Planning ;

- Buildings- Main /ancillary /Services
- Roads- Private/ Public/ services/VIP/ Pedestrian walkways
- Access– Cars/ Pedestrians/ walkways/ service vehicles
- Transport– Public transportation/ Private Cars/Taxis/ Motor cycles/Scooters/Cycles
- Landscaping- Softscape /Trees/green /hardscape- pavement, furniture- Benches, lighting etc
- Services- water supply/ sewerage/storm water drainage/ roads/electricity
- --Parking– Ground/ underground/ stilts

Site Planning- Process

Site Planning process involves;

--Evaluation of existing/identified site in the context of

-- Proposed development Program

-- Environmental impact

--Impact on communities

- Impact on neighborhood properties

-- Project Design

Site Analysis Involves—

--Environmental Program

--Development Constraints

-- Development Opportunities

Well defined, well designed and well executed site analysis- critical to evolving ;

- cost-effective; Environmentally sustainable; - eco- friendly; Design solutions
- Site analysis also involves identifying—Buildable Zone, Non- Buildable Zone, Area to be preserved; area for upgradation

Site Planning Principles

i) Neighbourhood Character
ii) Physical Characteristics
iii) Site and Slopes
iv) Set backs
v) Minimum Fingerprints of Building
vi) Minimum damage to site
vii) Design with Nature and local Culture
viii) Promoting Pedestrianisation
ix) Using hierarchy of
-- Preservation,
-- Conservation and
-- Regeneration

Site Planning Principles

Site planning / design--- **Need to consider broad range of concerns before evolving design concept.:**

---physical aspects of site
--vision/ program of client,
---designer's own creative inclination,
-- concerns of community
---interests of end user.
--- zoning /bye-laws requirements -- to regulate the density / geometry of development, road widths ,parking and drainage requirements,
--- natural resource(protection) areas.

ii) Neighbourhood Character

iii) Physical Characteristics

Site planning incorporate an accurate description of:

- **Shape, size, orientation of site and easements.**
- **Levels / contours of site and**

-- difference in levels between site / surrounding properties.

- **Location/ height of existing buildings on site and surrounding properties.**

use of surrounding buildings, including location of habitable rooms.

Site Planning Principles

iv Set backs;

- Set backs most important in site planning and positioning of buildings
- Adequate Set backs vital for promoting sustainability and livability
- Identify worst orientation and leave minimum set backs.
- Maximum setbacks given in the front for safety, security, sealing from noise, privacy, developing green spaces, avoiding demolition during widening/laying infrastructure-specially when facing North/east
- Leave minimum setbacks for fire safety, air-light and ventilation in buildings
- Identify open spaces to be left within buildings before siting of buildings and defining setbacks

Site Planning Principles

v) Site and Slopes

- Good designing follow grades and run along ridge lines.
- Steep site slopes often require increased cut and fill, if building are sited using conventional methods of designing
- If incorporated into initial subdivision/layout process-- slope can be asset to development..

vi) Use Site Finger-printing

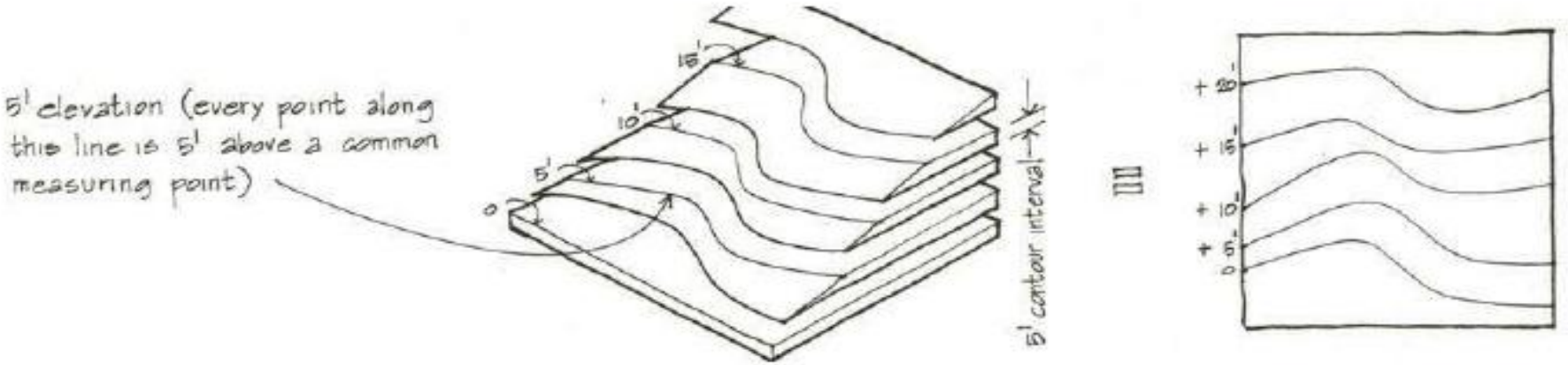
- Site finger-printing (minimal disturbance techniques) can be used to:

-- further reduce limits of clearing and grading
--minimizing hydrologic impacts.

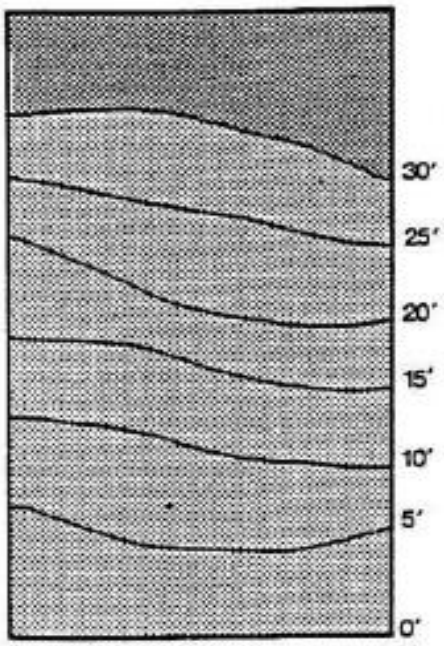
Site fingerprinting includes:

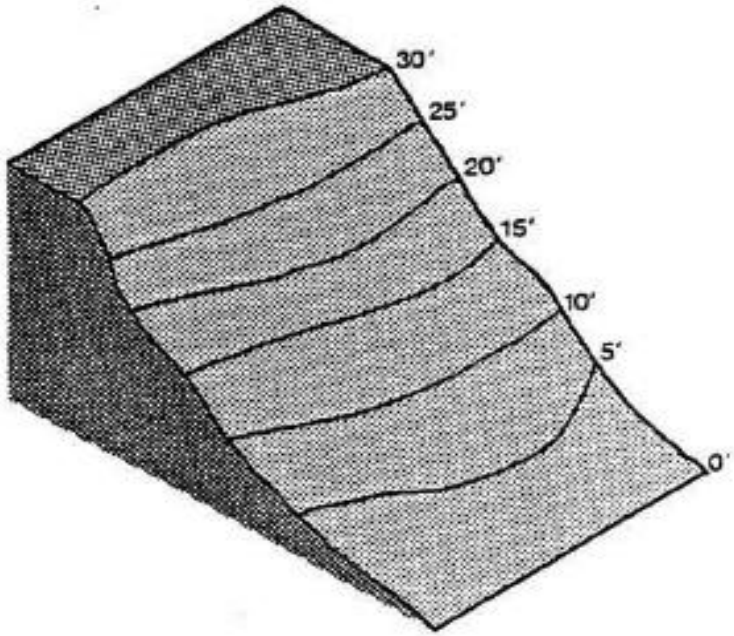
-- restricting ground disturbance by
-- indentifying smallest possible area
--clearly delineated on site.
-- Reduce paving and
--compaction of highly permeable soils.

Sloping Site Analysis in 2/3 d

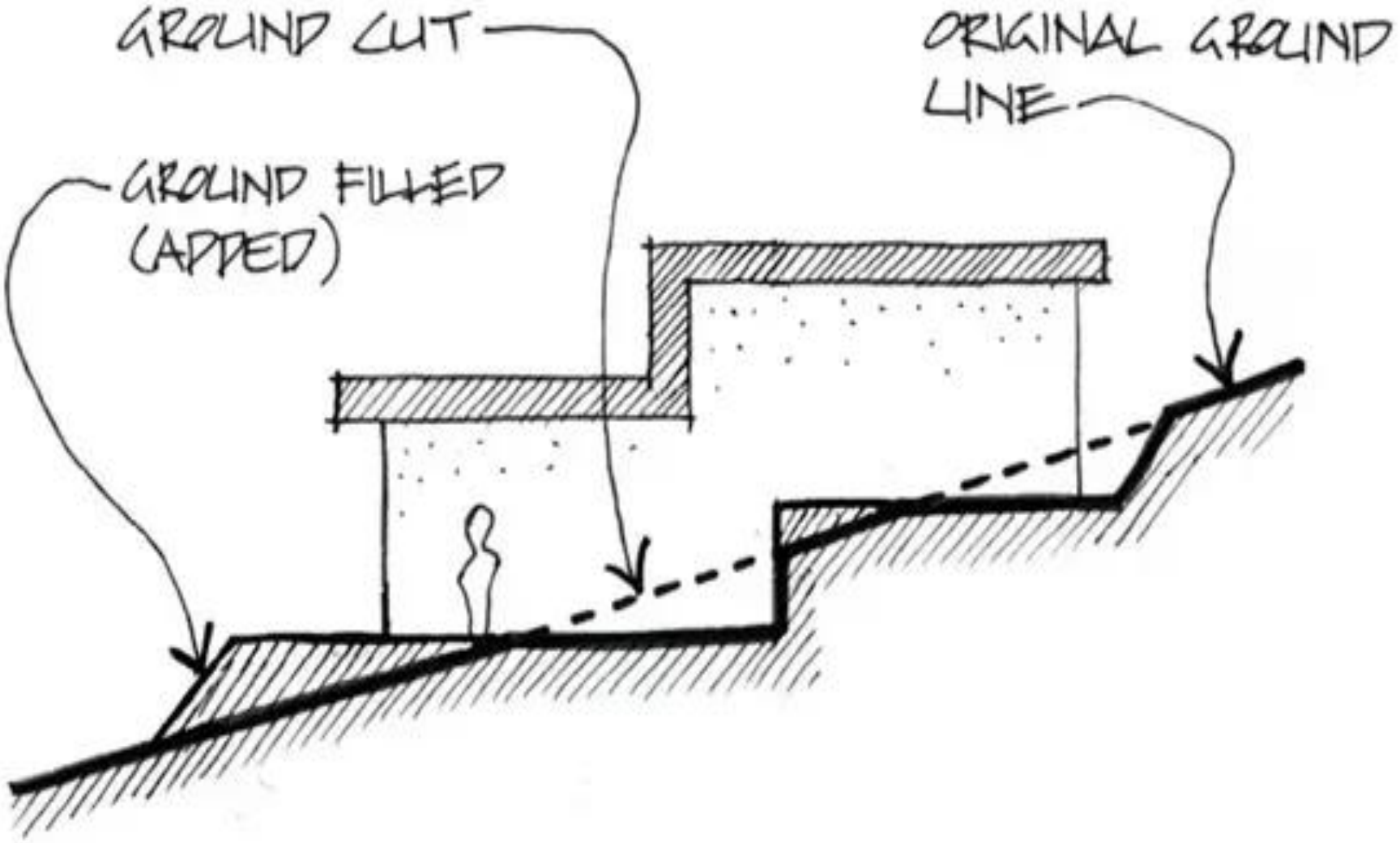


Relationship between 2-D and 3-D representation of site topography (contour lines)

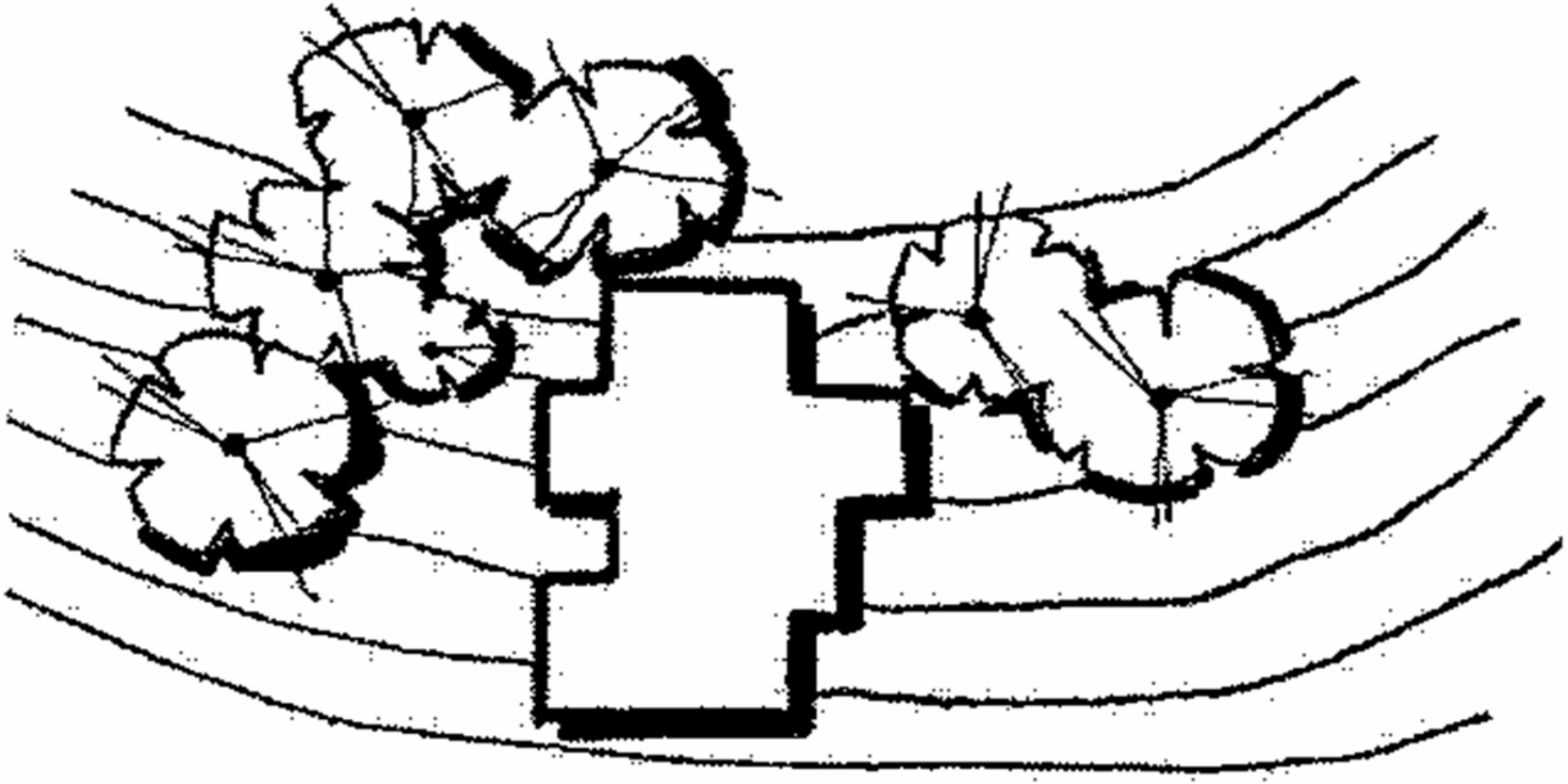




MANAGING SITE- MIN. CUTTING &FILLING

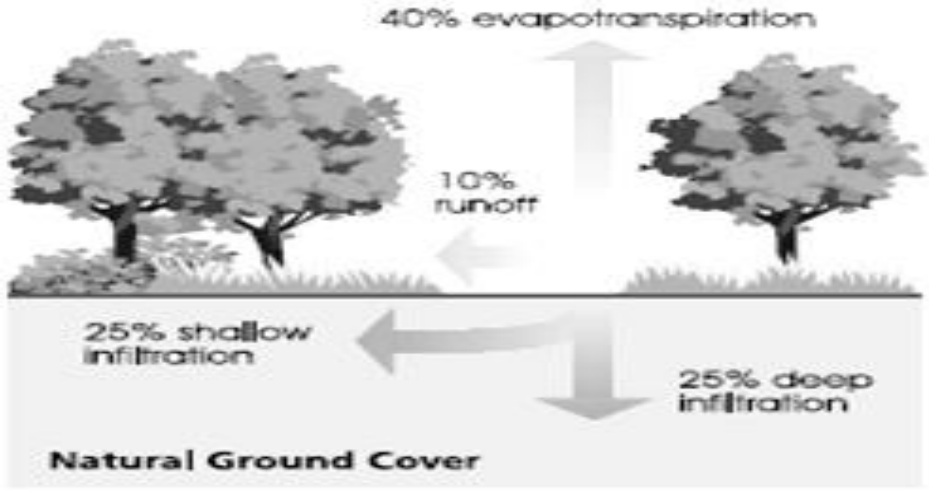


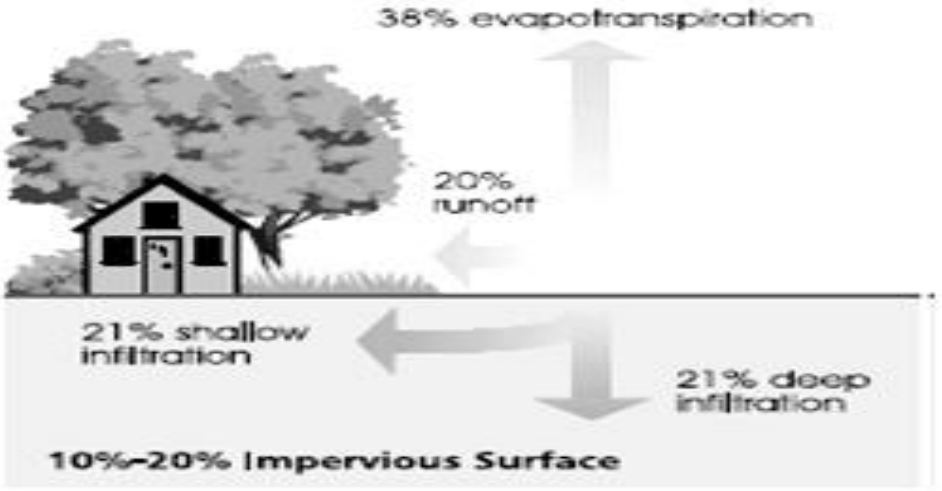
NOT THIS

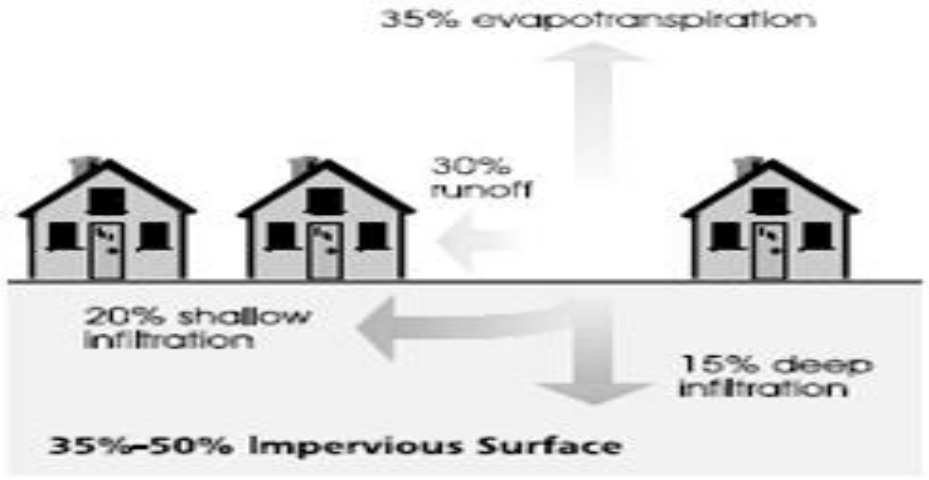


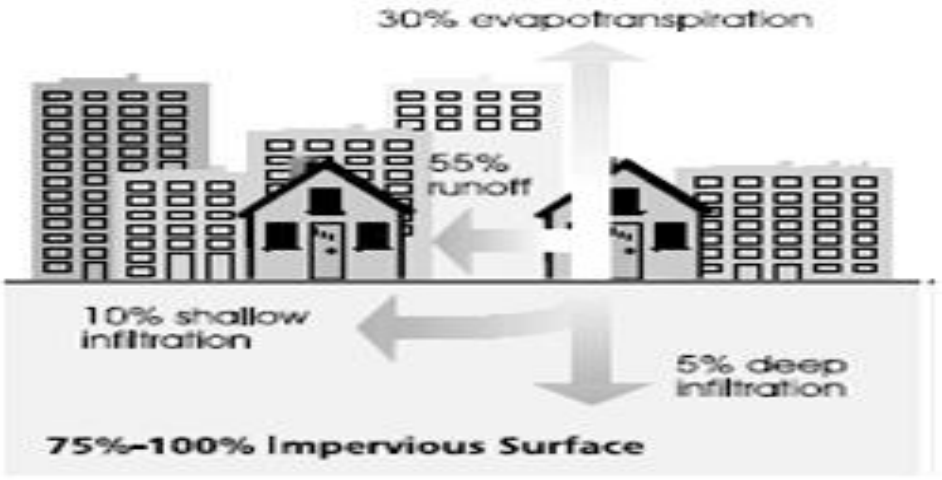
Building is perpendicular to the contours

Site Planning-impact of buildings- minimising Building Footprints









Site Planning Principles

vii) Minimizing damage/harm

--Make no changes to site that will degrade the surrounding environment.

---Promote projects on sites -where previous disturbance /development presents an opportunity to regenerate ecosystem services through sustainable design.

viii)Design with nature and culture

Create and implant designs that are responsive to :

-economic,

-environmental, and cultural conditions with respect to :

-- local, regional, and global context.

ix)Planning New Pedestrian Links

–to promote Pedestrianization and minimising vehicular traffic

x) Use hierarchy of preservation, conservation, and regeneration

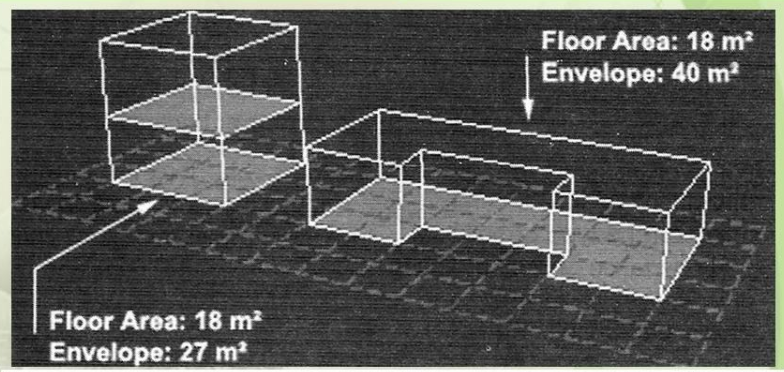
Maximise the benefits of ecosystem by :

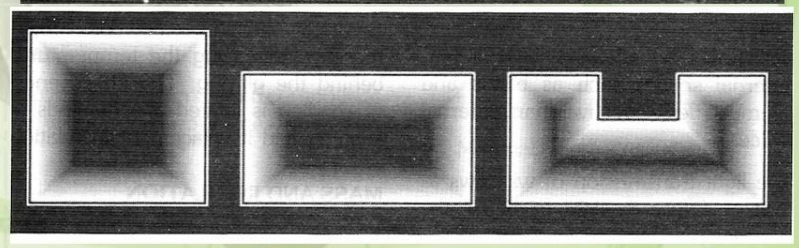
--preserving existing environmental features

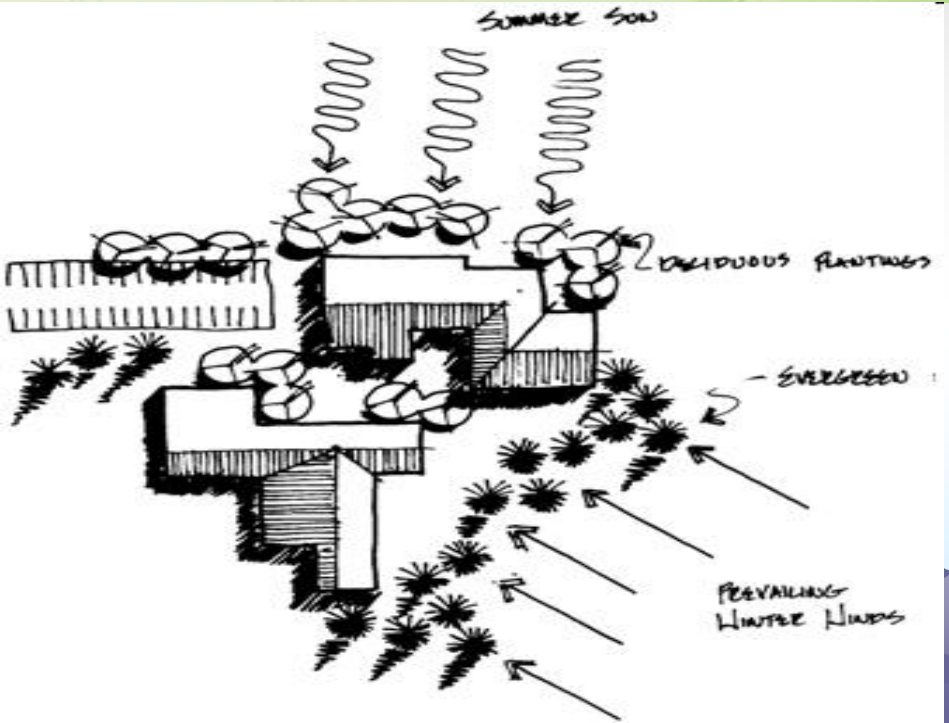
--conserving resources in a sustainable manner, and

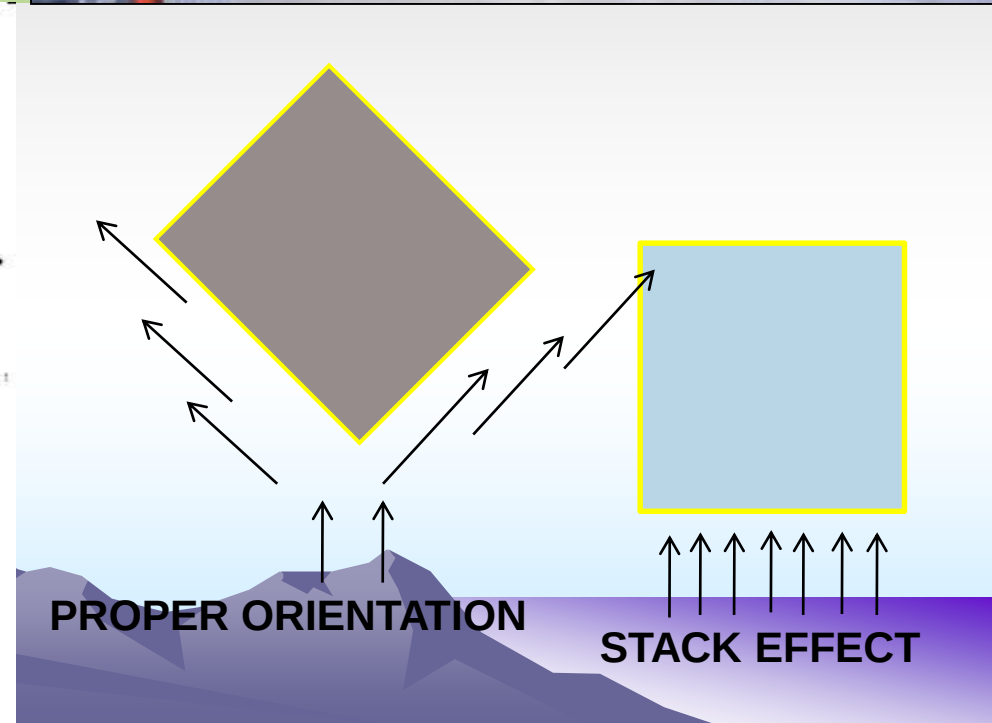
--regenerating lost or damaged ecosystem services.

Shape


Floor Area: 18 m²
Envelope: 40 m³
Floor Area: 18 m²
Envelope: 27 m²




SUMMER SUN
DECIDUOUS PLANTINGS
EVERGREEN
PREVAILING WINTER WINDS


PROPER ORIENTATION
STACK EFFECT

- **Conclusions**

Site Planning and Building Design

- **All state of art building designs have their genesis in careful site analysis.**
- **Before going for site planning / building design- ensure site properly/accurately surveyed -- mapping everything within/ outside site which would be relevant for planning/designing**
- **Site Survey should include;**

✓ **-dimensions of outer boundaries,- angles of all sides,**

✓ **- contours/levels at regular intervals- gradient, landform, elevation, drainage pattern etc**

✓ **-existing trees/flora fauna- in terms of type, size, location, shape, pattern, aesthetics, ecology,**

- **-water bodies,- electric lines,**
- **- services- both underground /over-ground/within /outside,**
- **--roads- inside/outside,**
- **structures – within/outside ; area of site,**
- **-- views- within /outside**
- **--water table/ floodability –**
- **-- soil testing for determining the soil load bearing capacity**

Site Planning and Building Design

- --Locate North
- --Identify Wind direction /pattern of wind flow
- -- Define Setbacks to be left within building as per bye-laws
- -- Define 'No building Zone'- to be left within site as per Master Plan/National /State Highways law etc
- -- 'Define Mandatory No building zone'-- to be left when located near to defense installations/ protected monuments/ zoo/ botanical gardens/ electric installations
- -Define-'No Building Zone' --to be left when site located near water bodies/rivers etc
- --Defining right of way for High Tension Electric Lines when passing through site
- - Preferably obtain a Zoning Plan of site , when allotted by any Development Authority/Urban Local Body/Improvement Trust/ Industrial Corporation etc before starting planning

Site Planning and Building Design

- Site planning and building design would require simultaneous conceptualization.
- Site planning- for large sites calls for carrying out detailed analysis of site in terms of area to be preserved/ conserved/fit for development
- While dealing with large sites/educational institutions – site zoning must be done initially by drawing a master plan in terms of area for academics/ administration/ residential for staff/ hostels/play area etc along with broad road network
- Planning residential complexes to focus on keeping vehicles on periphery while making core as the pedestrian paradise
- Assess parking requirement and decide where to be provided- surface/stilts/ground- make provision of space for surface parking

Site Planning and Building Design

- Decision regarding project to be designed as single/multiple blocks would be critical-- considering site/area/ shape etc and distances to be left within different blocks.
- Respect abutting roads while positioning/ designing buildings- buildings to run parallel to abutting roads
- Set backs within site should be dictated by the orientation/legal framework – with minimum setback kept on worst side and large setback on the best orientation/front side
- Setbacks also be defined considering the open spaces to be provided within the buildings and the prevailing flora- fauna besides area to be used for landscaping

Site Planning and Building Design

- Lighting/ ventilation -also to dictate positioning of building- with north best for glare free/uniform/cool light
- Building design preferably dictated by golden mean ratio while considering proportions
- In irregular site- plan for regular buildings with walls running parallel to abutting roads and residual irregular spaces used for landscaping/set backs.
- In designing-- respect site, respect nature, existing topography and existing water bodies

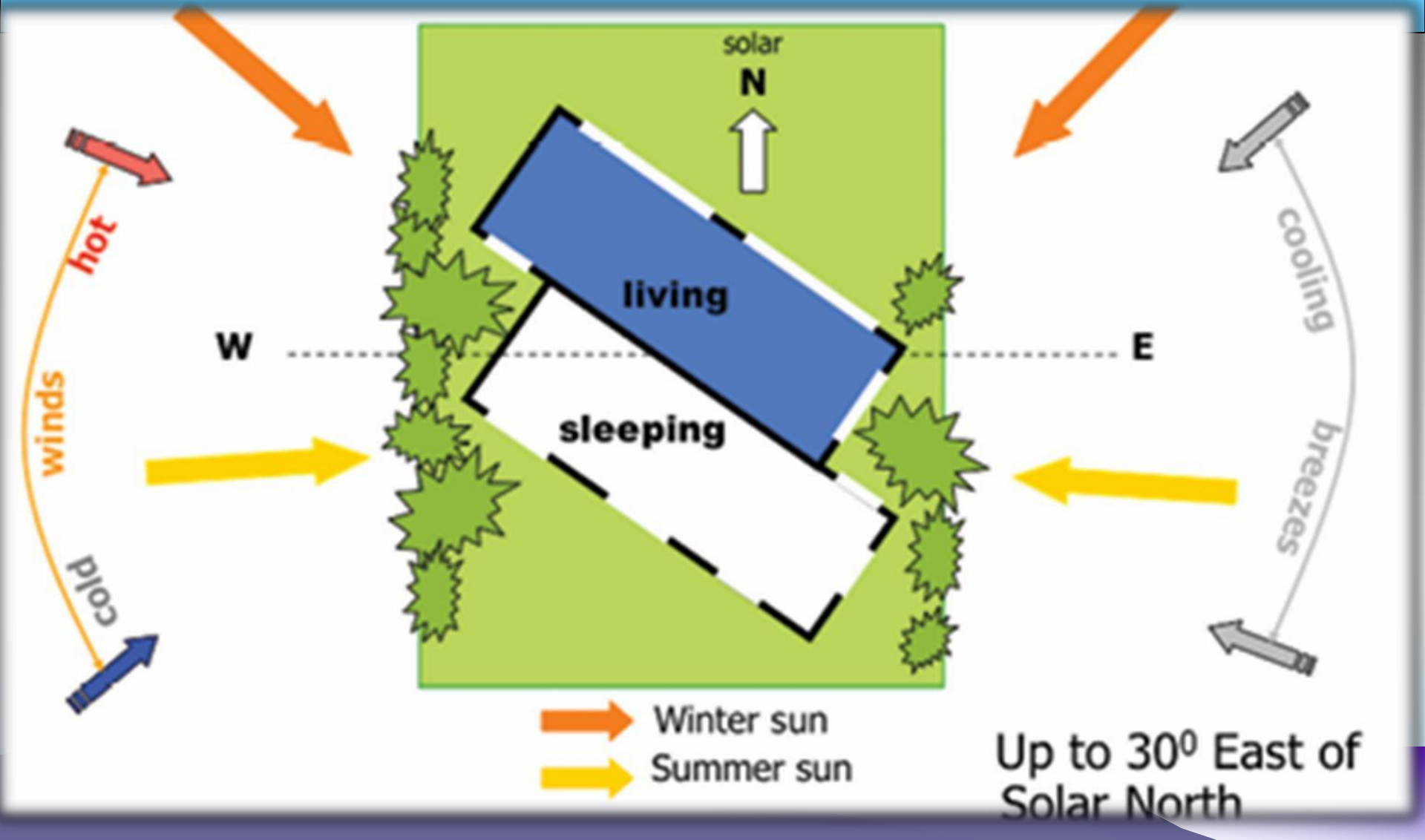
Site Planning and Building Design

- Site planning- based on Climate considered at Regional/ Settlement/Site levels
- Look for prevailing wind direction for site planning and positioning of buildings in site—
- Look for desirable winds/undesirable winds
- Look at the orientation context for site planning
- Look at the views from/to site– make best use of views focusing on nature, avoid views of slums /industry /pollution etc
- Carry out land suitability analysis in large projects for defining areas needing preservation/conservation/ fit for development/unfit for development for rational site planning

Site Planning and Building Design

- Site and project design should be compatible
- - Building design should be response to the available site
- Size/shape/location /levels etc will largely dictate the site planning/ building design
- Avoid pre-meditated building design
- Plan along contours- Planning across contours involves large cutting /filling- making project cost-intensive, environmentally unsustainable
- - Avoid building on steep slopes - reject sites which are very steep
- -- Avoid north slopes for construction in hilly
- - Plan for compact buildings with large site area left as natural- have as small footprints of building as may be possible/feasible
- - Mark all existing trees -plan for their protection while site planning
- - Trees coming within buildings be made part of building by adjusting them in open spaces or shaping the buildings to exclude them
- -mark low lying area for rain water harvesting/ locating STP
- Plan higher areas for locating water supply through gravity
- Use native plants for landscaping and minimize plantation from different climate

Site Planning/building design dictated by orientation & Climatic conditions



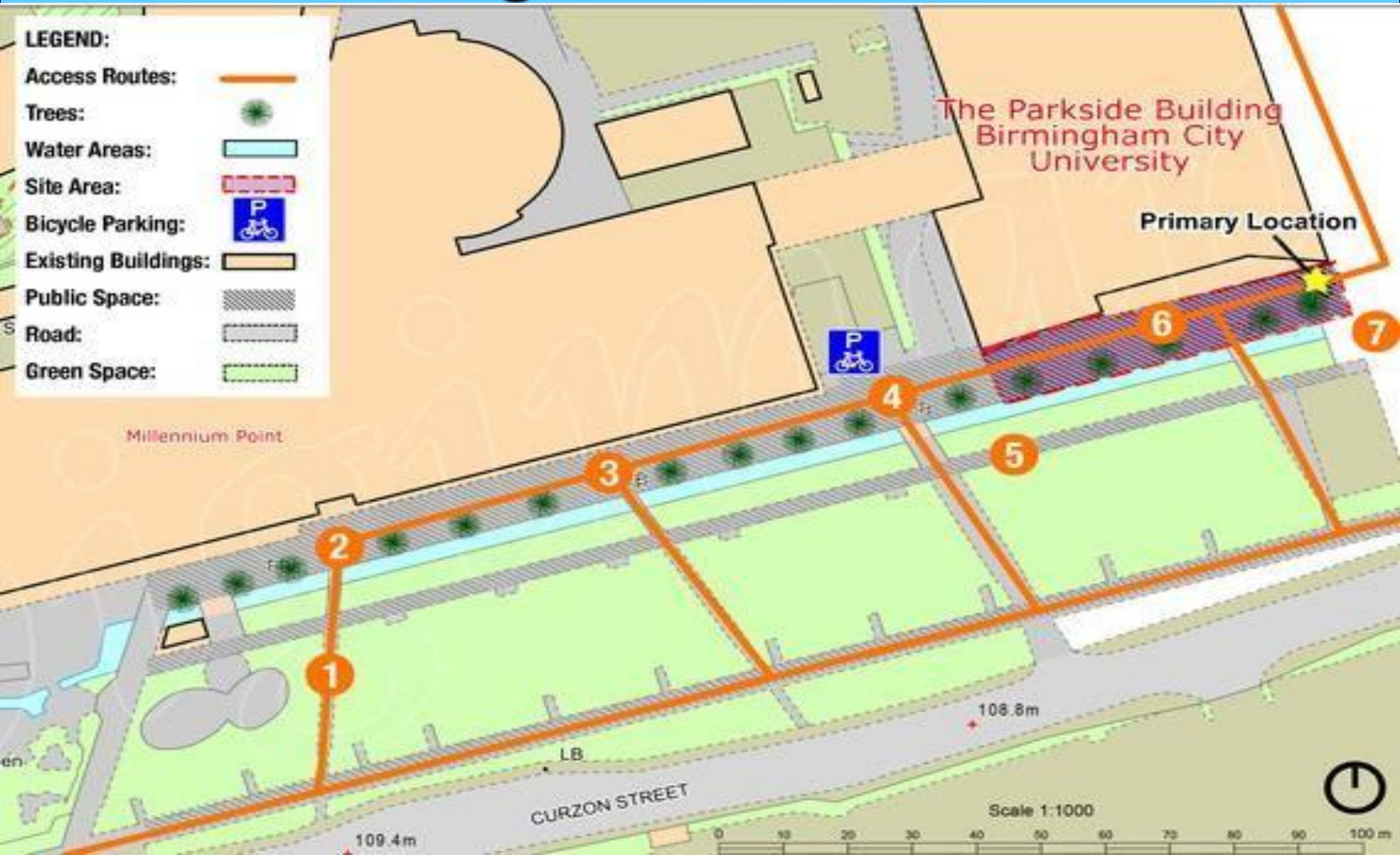
Site Planning involves consideration of existing views from / to site

Views from/to the site

Site Planning in already built area

Site Planning in a Regular Site

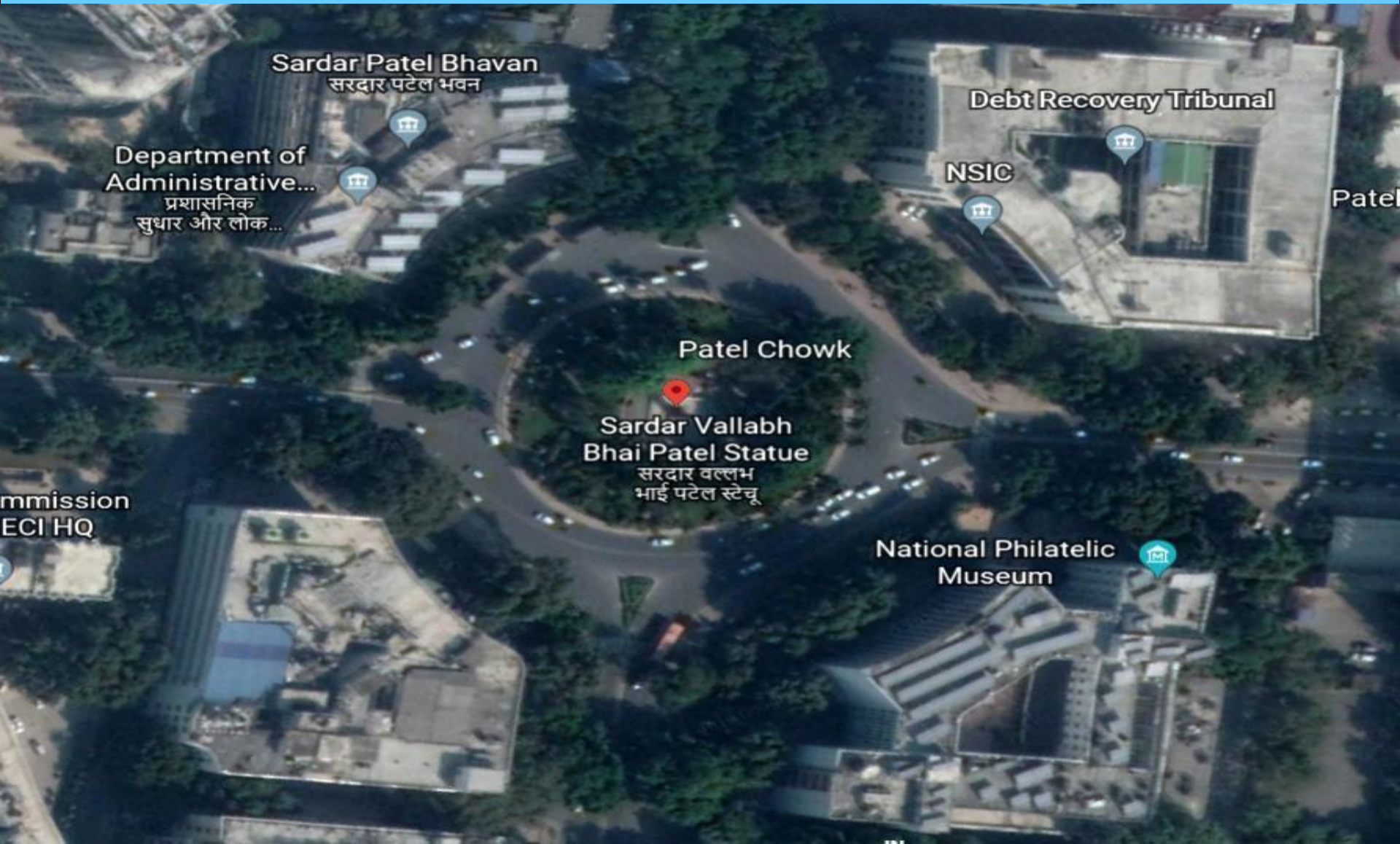
Site Planning involves consideration of existing views from / to site



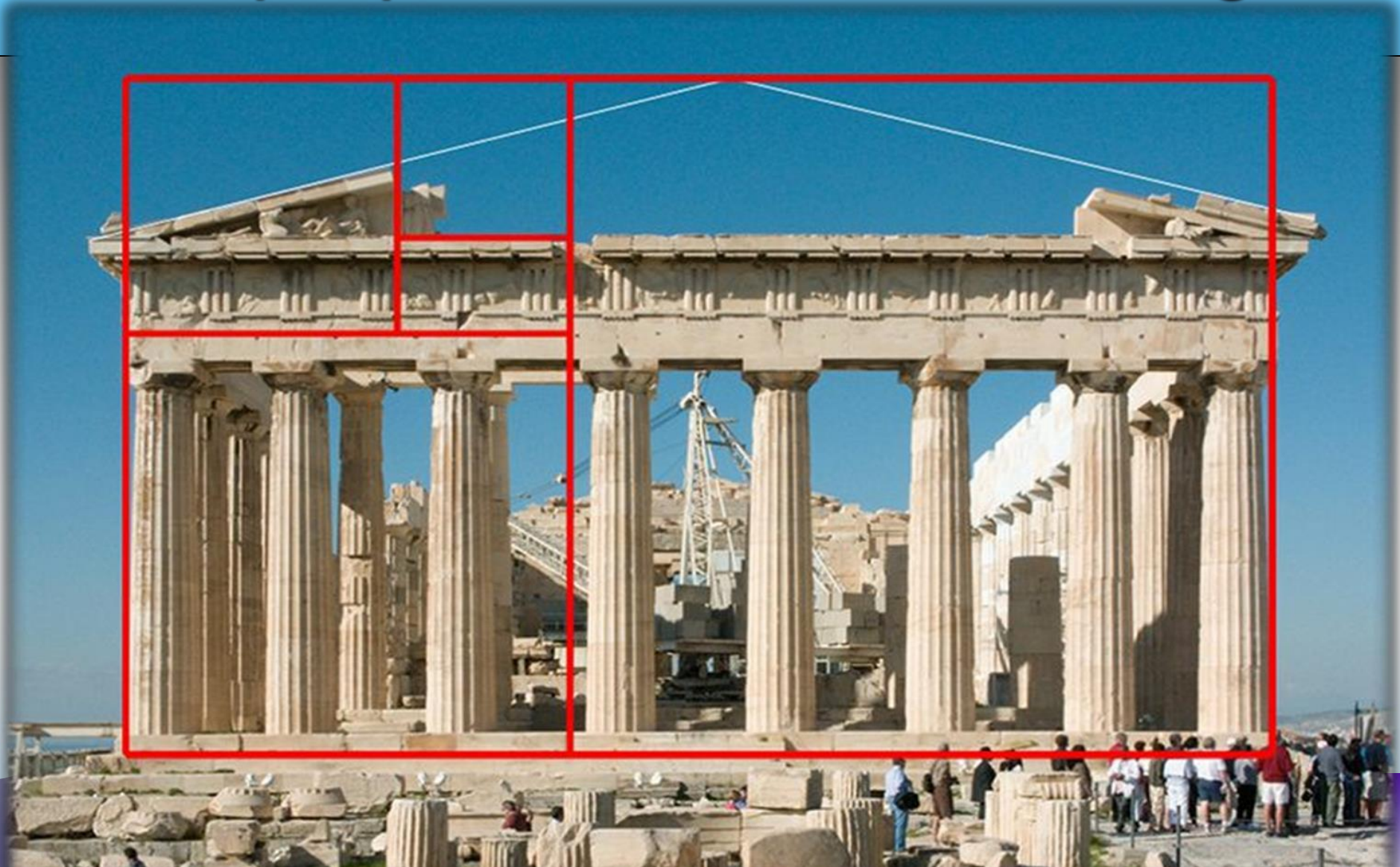
Site Planning dictated by respecting site, existing water bodies, flora/fauna, nature, topography

Plan for Regular Buildings in Irregular sites with walls running parallel to abutting road with irregular spaces left as the green spaces adjusted in set backs

Respecting shape of abutting roads while positioning/designing buildings



Golden Mean Ration should dictate the proportions of the buildings



AND SEARCH FOR PROMOTING RATIONAL SITE PLANNING CONTINUES AS FORMIDABLE CHALLENGE TO ARCHITECTS