Site Selection

Civil Engineering
Construction & Graphics

Lecture # 7

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Site Selection

- The site of a building greatly affects its **planning, design and construction.**
- It may be **selected as required** or **accepted as available.**
- The selection of site depends upon the **purpose** for which the proposed building is to be constructed.

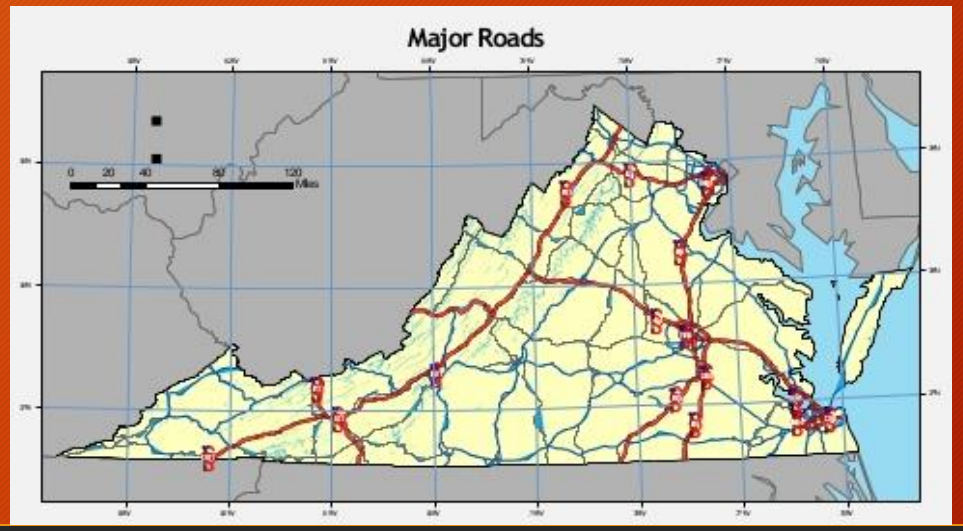
Building Construction - Orientation of Buildings
Factors affecting Orientation of Buildings

(1) Surrounding of the site

The building is to be orientated **to suit the surroundings** of the site.

(2) Proximity of a road or street

The building should be so orientated, as to provide **easy approach** from the nearby road or street.

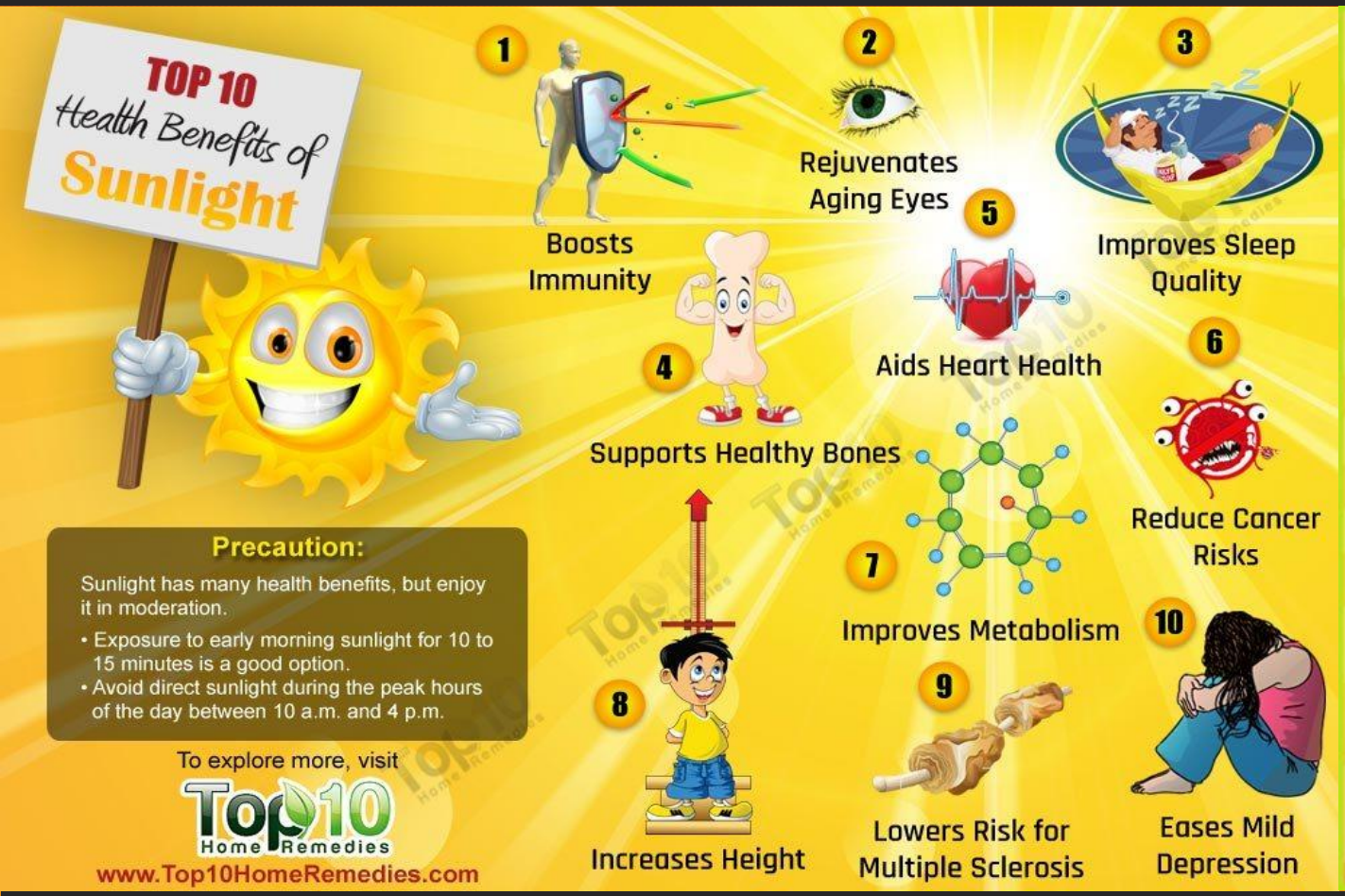


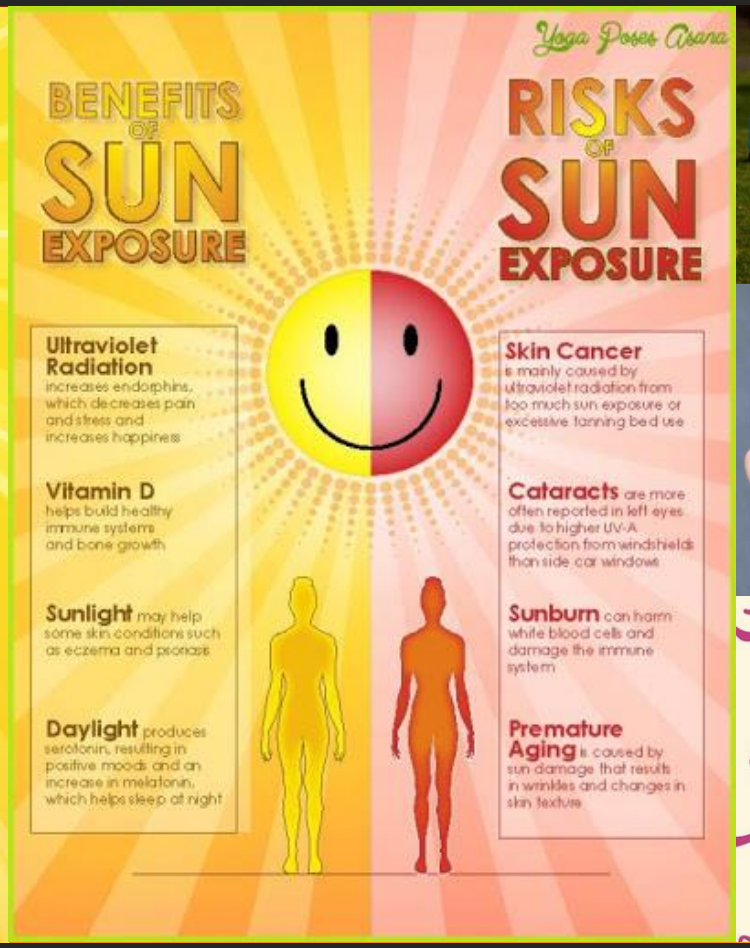
Building Construction - Orientation of Buildings
Factors affecting Orientation of Buildings

(3) The sun

- The sun is a source of **natural light** and **temperature.**
- Sunlight is a powerful agent for **killing the germs** of harmful diseases like, tuberculosis, typhoid, cholera, etc., which may, otherwise, breed in the dark and damp corners of the building.
- It is, therefore, essential to orientate the building such that the **sun rays** may fall sufficiently on the building and **enters the building through doors and windows.** However, **in summer,** the building should also be **protected from its severe heat.**

Building Construction – Orientation of Buildings
Necessity of Natural Sun Light





Building Construction - Orientation of Buildings
Factors affecting Orientation of Buildings

(4) WIND

- The building should be so orientated that **cool breeze** enters the bedrooms **during night** in **summer** but not in winter.
- It should also **prevent direct entry of wind** of heavy intensity into the building, so as to protect the residents from **dust nuisance.**

(5) RAIN

- The building should be so orientated, so as to **prevent entry of rain** inside the rooms.
- It should also provide minimum portion of the building subjected to direct showers of rain, so as to **prevent dampness** inside the building.

Building Construction - Orientation
Natural Ventilation Benefits

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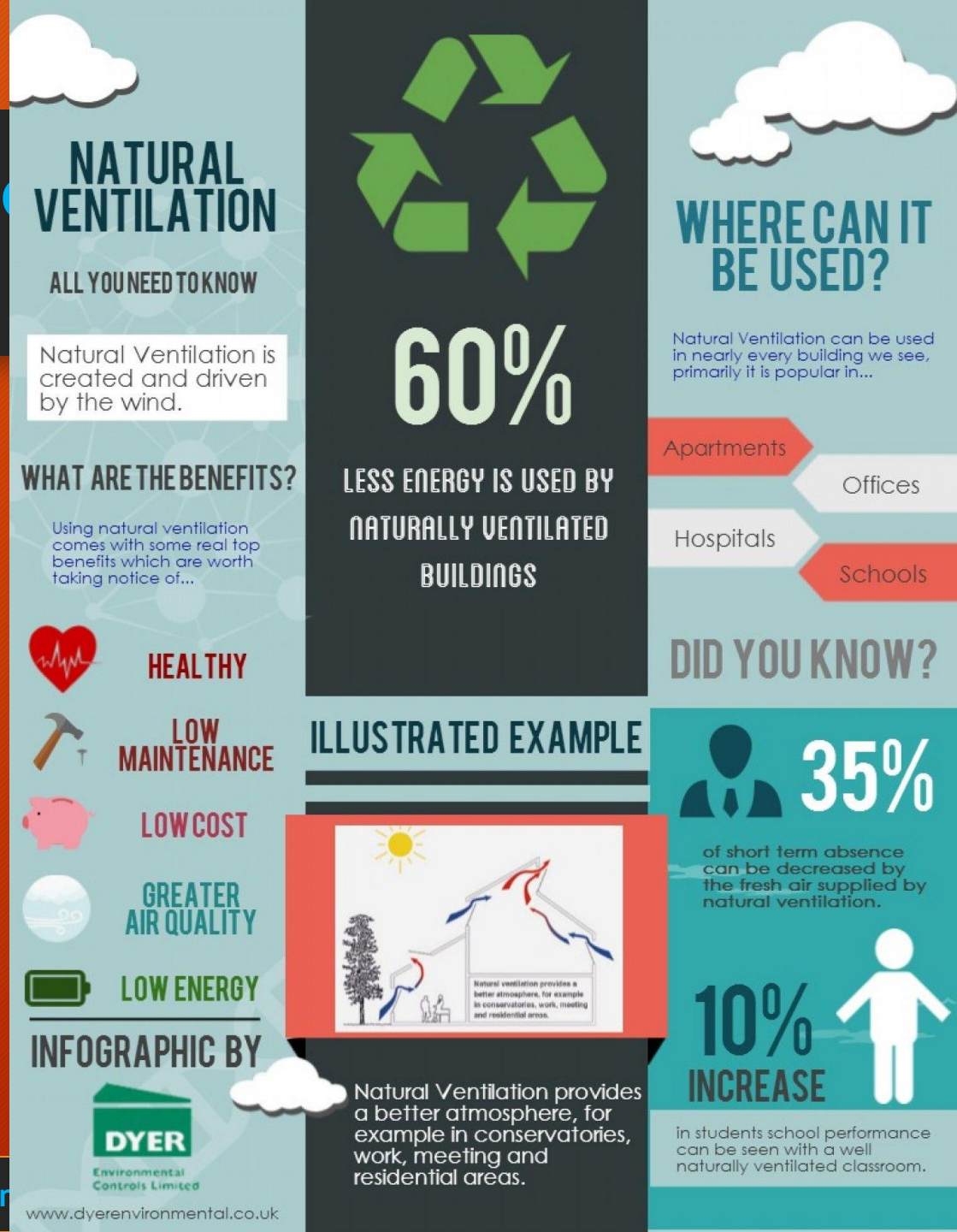
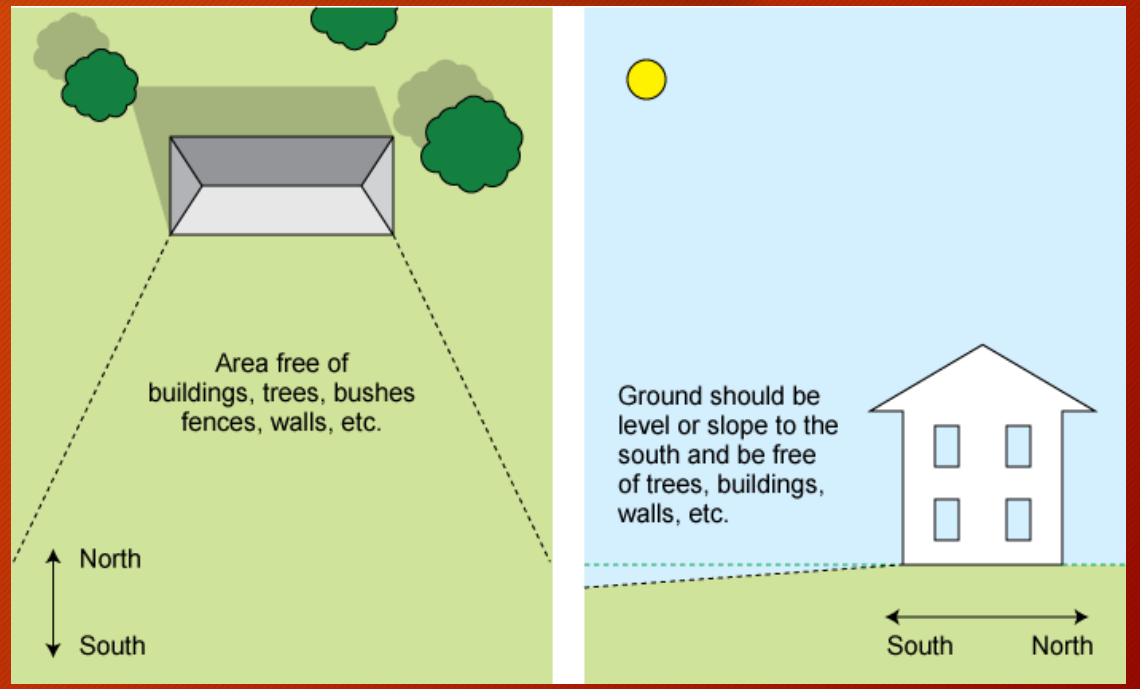


Building Construction - Site Selection
Factors to be considered for Site Selection

The selection of a building site is very important for a solar heated home or building. Windows that face South will need to be able to have direct, solar gain enter the windows for most of the day. You will need to inspect the building site with a compass to determine if the Southern direction is free of conifers (pine trees), buildings, walls, hills or anything that would block sunlight from entering windows in the Winter.

Ground should be level or slope to the South. Ground should be free of buildings, walls and pine trees. Deciduous trees (with leaves - falling off at maturity) may be OK. These trees provide shade in the Summer and will allow the sun's rays to penetrate after the leaves fall off. Remember, some of these trees do not drop their leaves until late in the Fall.

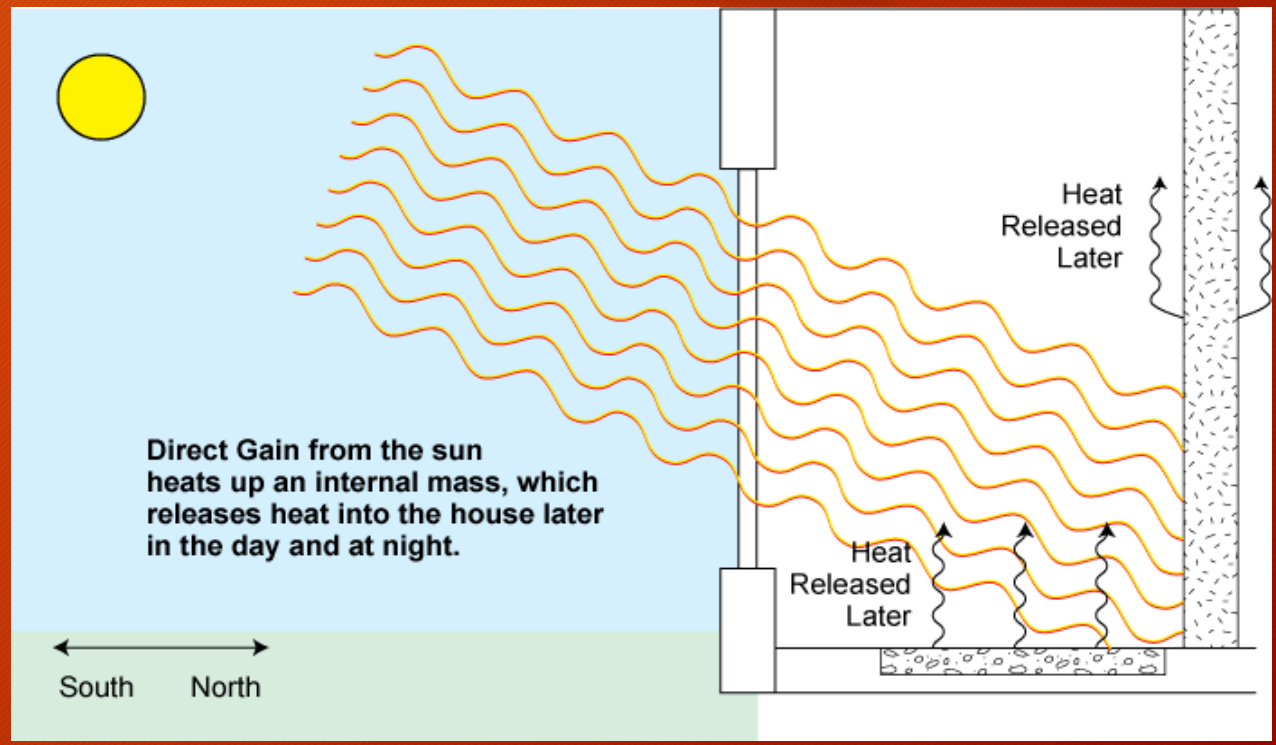
Use your Judgement!



Building Construction - Site Selection
Factors to be considered for Site Selection

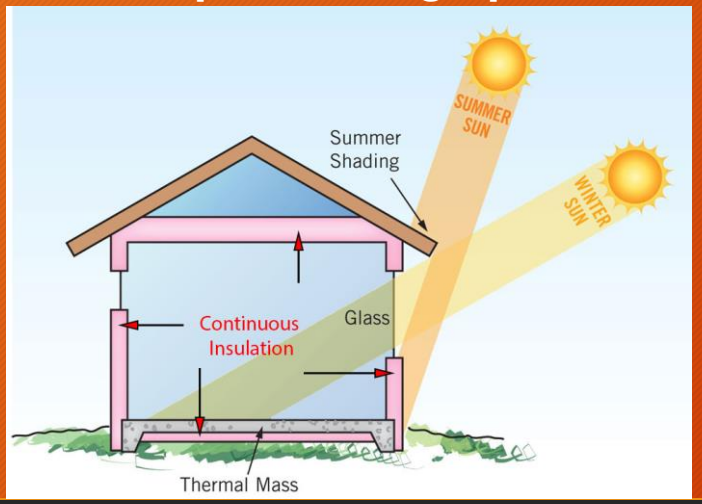
Passive solar heating is accomplished by allowing the Winter sun to heat up living space air and an internal mass which releases heat later in the day or night. The radiant heat from the sun must be allowed to enter through South-facing windows and be captured by surfaces that are painted dark colors (black is best).

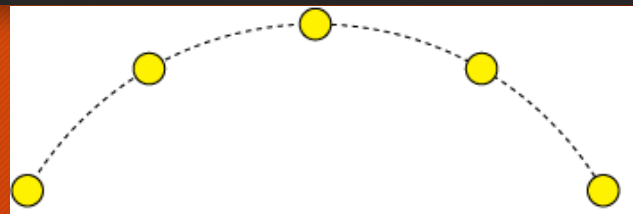
A floor mass is constructed of concrete, rocks and sand. These items are inexpensive and require no moving parts. Insulation should be placed over the windows at night so heat will not escape. There are a variety of insulated curtains, blinds or panels that can be placed over windows to decrease heat loss at night. The homeowner will need to be creative to obtain and use this insulation. This insulation is removed on the following day, to allow the sun once again to heat up the living space and internal mass.

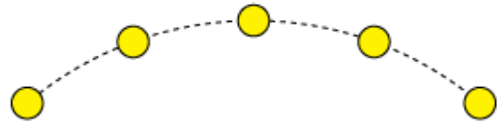


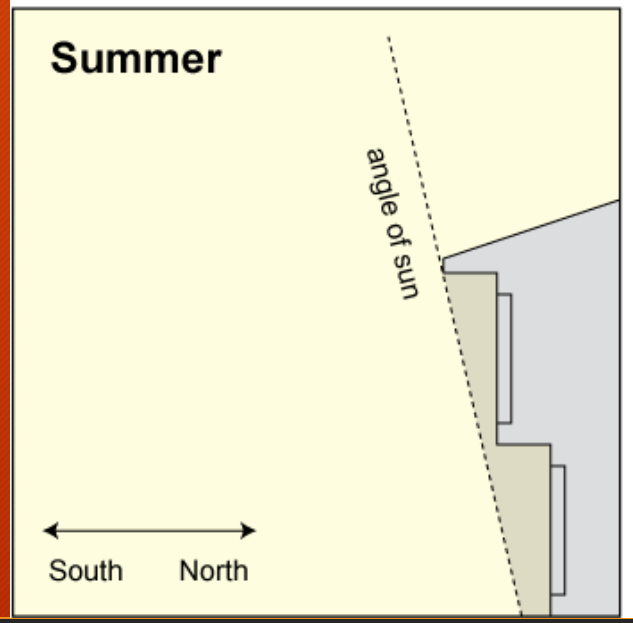
Building Construction - Site Selection
Factors to be considered for Site Selection

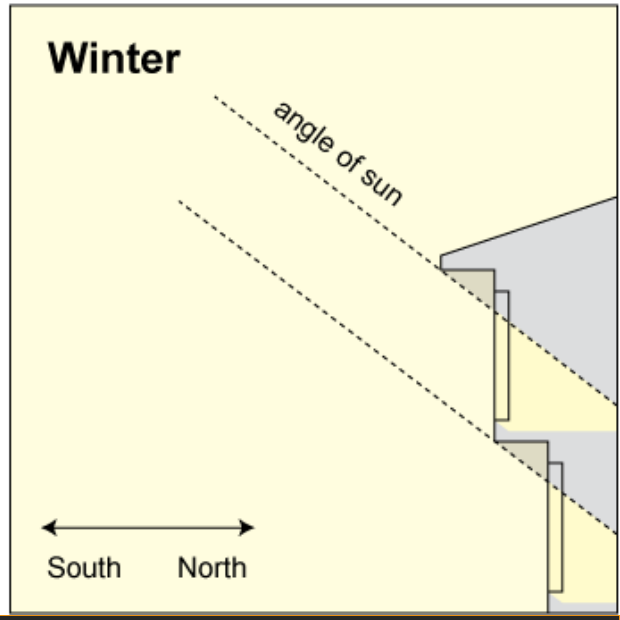
Overhangs or awnings can shade the South-facing windows in the Summer. Because the sun rides lower in the Winter, the construction of the house can allow solar heat gain to enter the South-facing windows, warm up the living space and heat an internal mass.











Building Construction - Site Selection
Factors to be considered for Site Selection

(1) Level of the site

The level of the site must be **higher than that of its surroundings**, so as to provide **good drainage.**

(2) Climatic Conditions

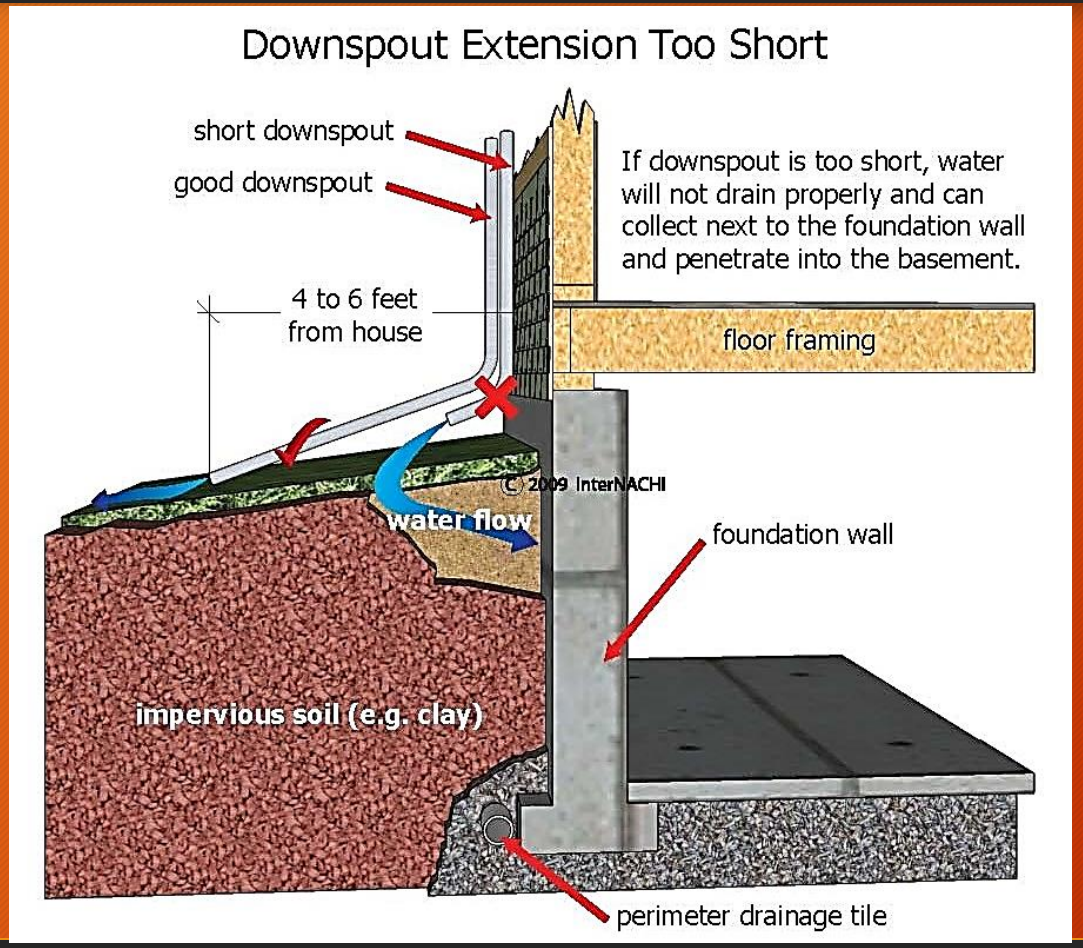
The **intensity of rainfall** and sub-soil water level should be **low,** so as to **avoid dampness** in the building.

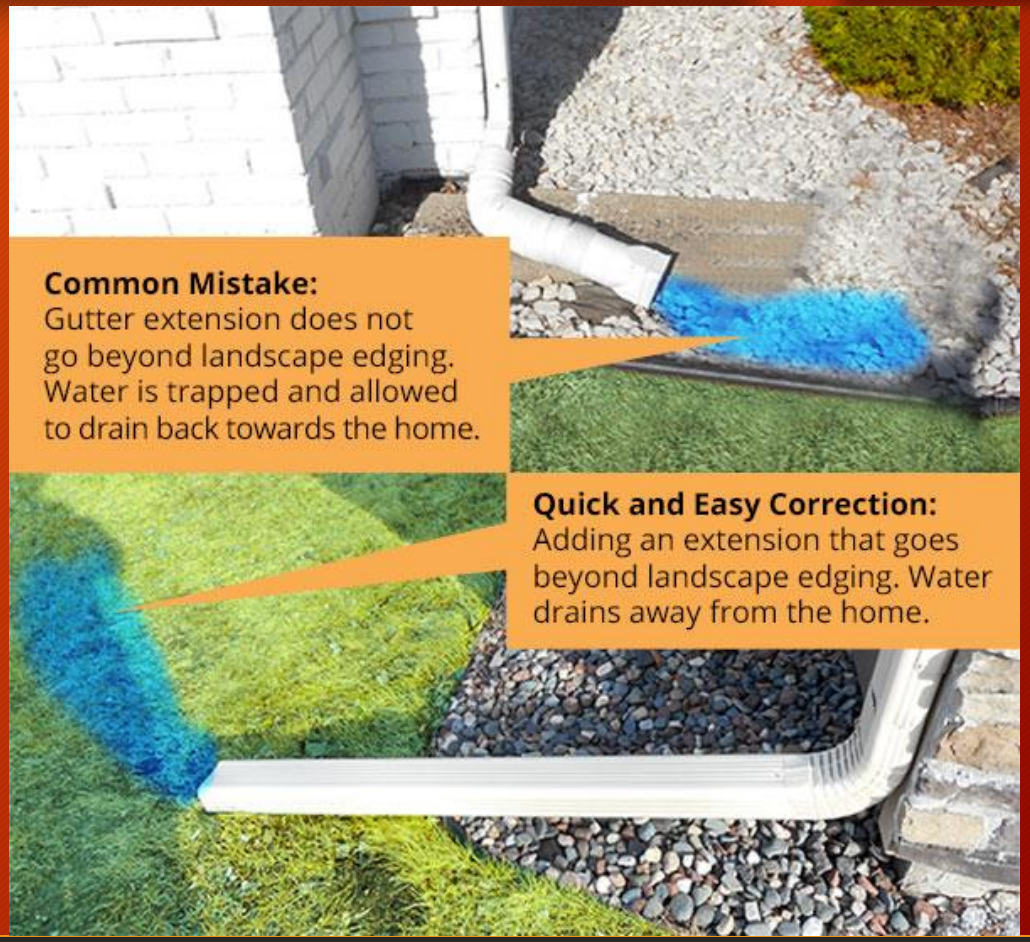
Climate is the long-term average of weather, typically averaged over a period of 30 years.

A downspout, waterspout, downpipe, drain spout, roof drain pipe, leader is a pipe for carrying rainwater from a rain gutter.

Building Construction - Site Selection

Factors to be considered for Site Selection

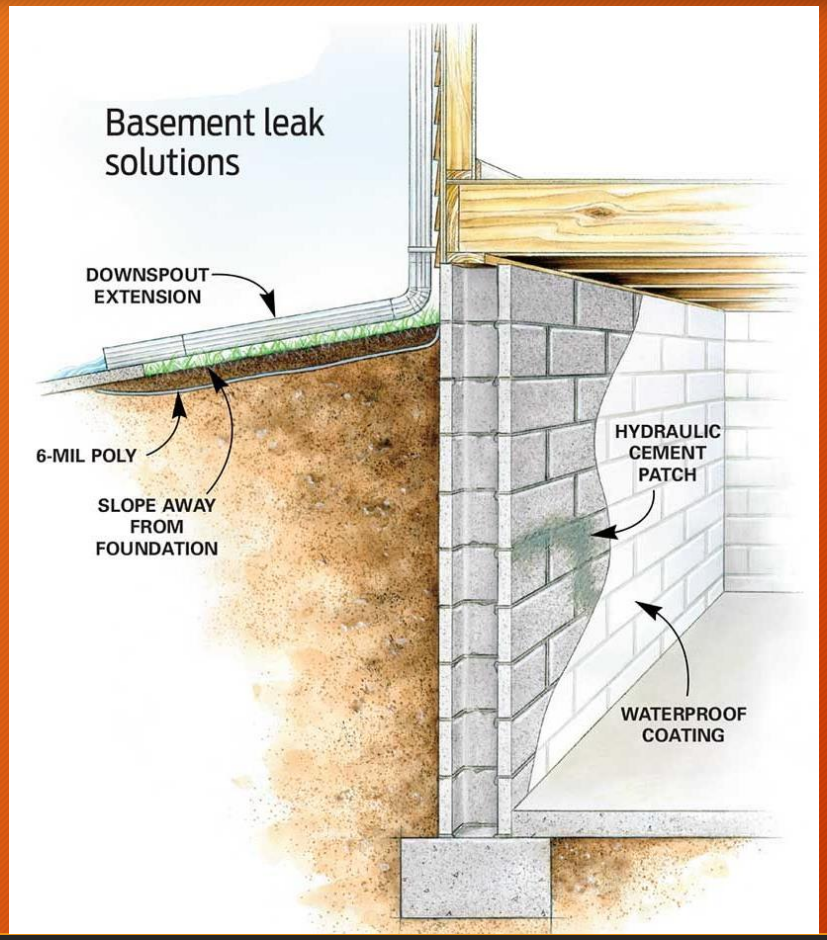


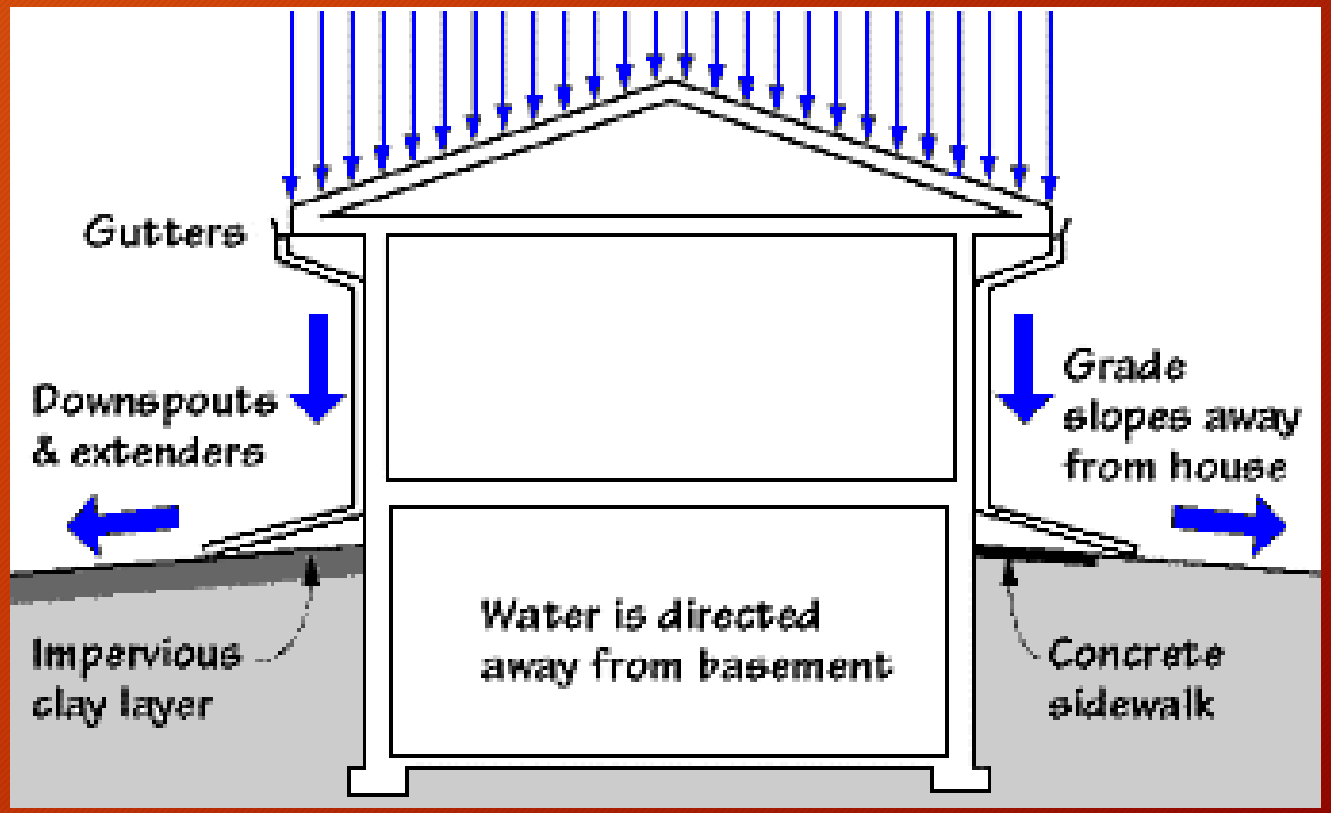


Gutter: a shallow trough fixed beneath the edge of a roof for carrying off rainwater.

Building Construction - Site Selection

Factors to be considered for Site Selection





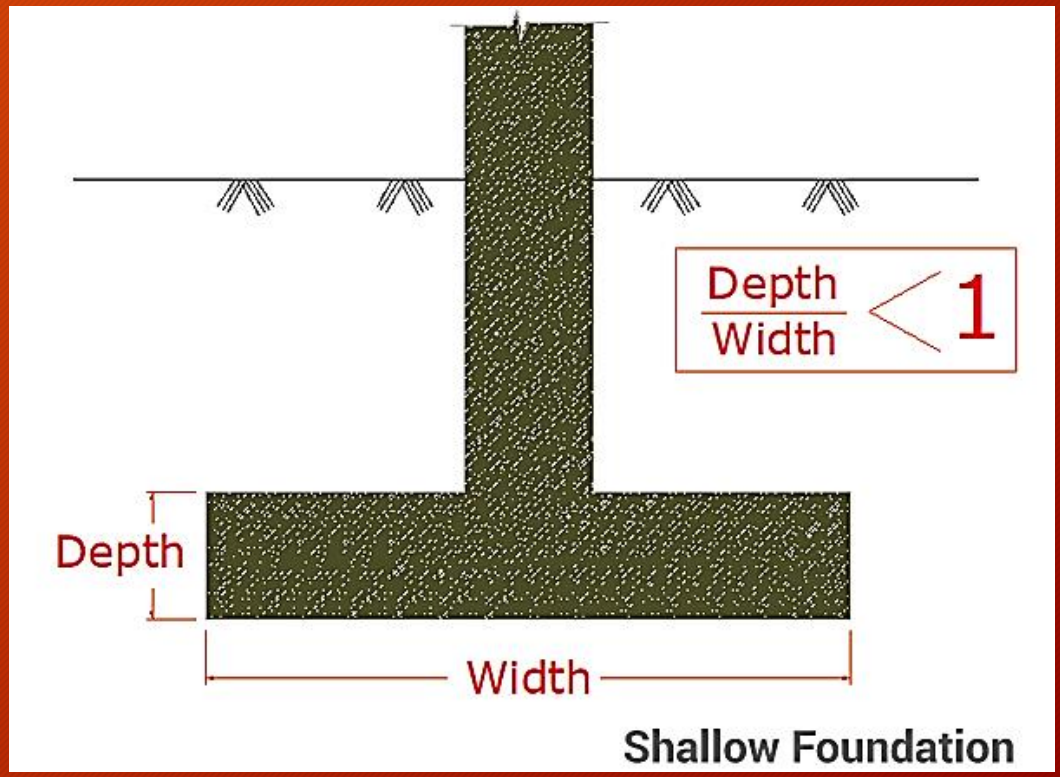
Building Construction - Site Selection
Factors to be considered for Site Selection

(3) Sub-soil Conditions

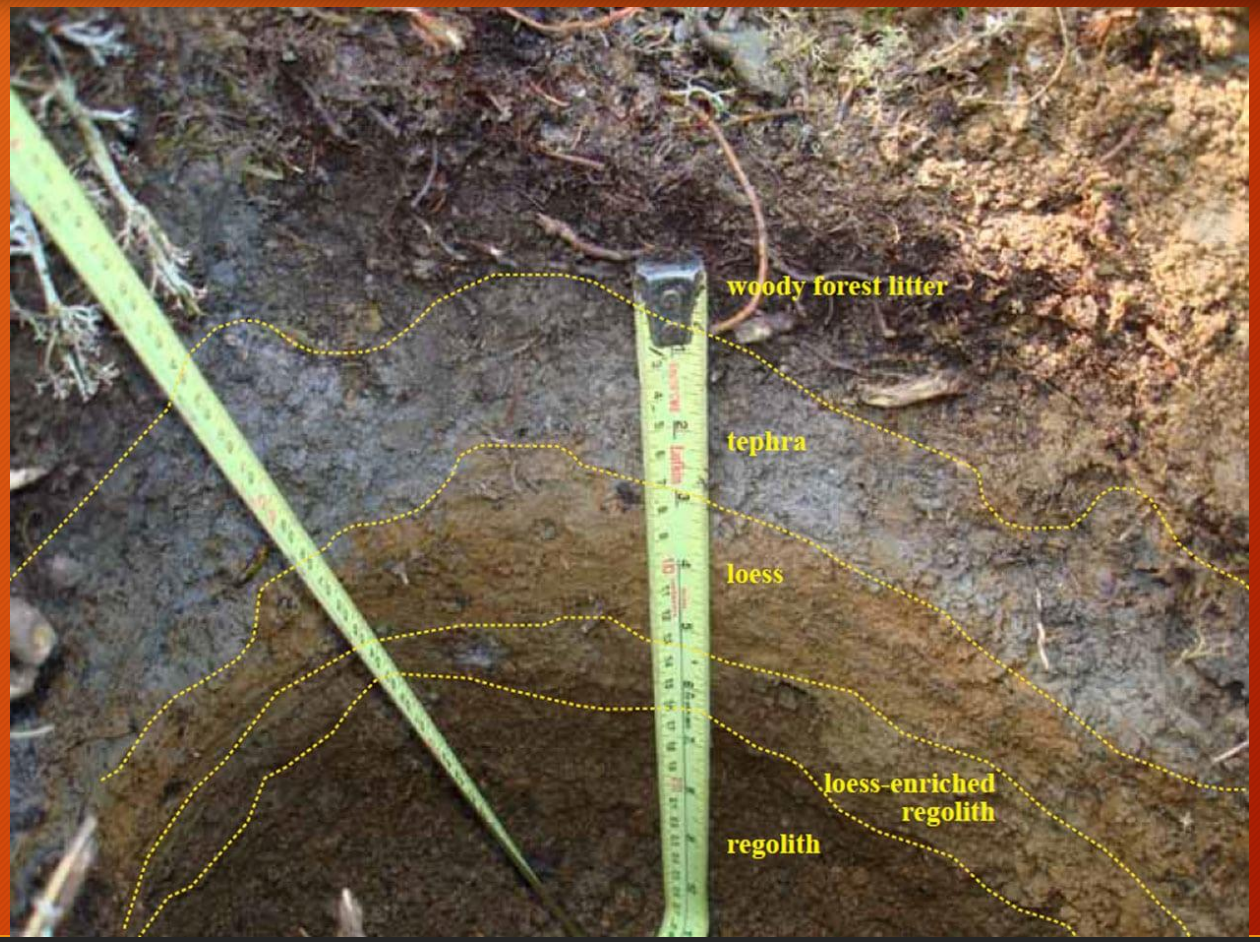
A **hard stratum** should be available at a reasonable depth (3ft to 4 ft from the ground level), so as, to construct the **foundations** of the building **safely** and **economically.**

(4) Availability Of Modern Amenities

The site must be **within municipal limits,** so that, modern amenities like, **water supply, electricity, sewerage, roads,** etc. can be made available with more ease, if there is no provisions at present.



Building Construction - Site Selection
Factors to be considered for Site Selection



Building Construction - Site Selection
Factors to be considered for Site Selection

(5) Availability of other Facilities

The site should provide an easy access from the nearest road and offer sufficient light and air. There should be good and cheap transport facilities available near the site. It is always better, if public services like, fire brigade, police station, schools, etc., are also not very far off from the site.

(6) Surroundings

The situation and surroundings of the site must be such as to suit the purpose for which the building is to be constructed. Each type of building requires different surroundings, than for others.

E.g. A house should not be constructed in industrial area.

Building Construction - Site Selection
General Precautions in Selection of Site

(1) The site consisting of **reclaimed soil** (made useful for cultivation) should be **avoided**, as far as possible.

(2) The site must not be **located** in **water logged areas** or near the **bank of a river.**

(3) **Old quarry sites** must be avoided, as far as possible.

(4) The site for a **residential building** should be away from the area causing foul odor or smoke nuisance due to **industrial buildings.**

Building Construction - Site Selection
General Precautions in Selection of Site

(5) The site for a residential building, school or hospital should be away from noisy areas.

(6) There should be no disabling easement (Easement is a right, which a person may have over another man's land by law, such as, the right to walk over it or to run a pipe through it).

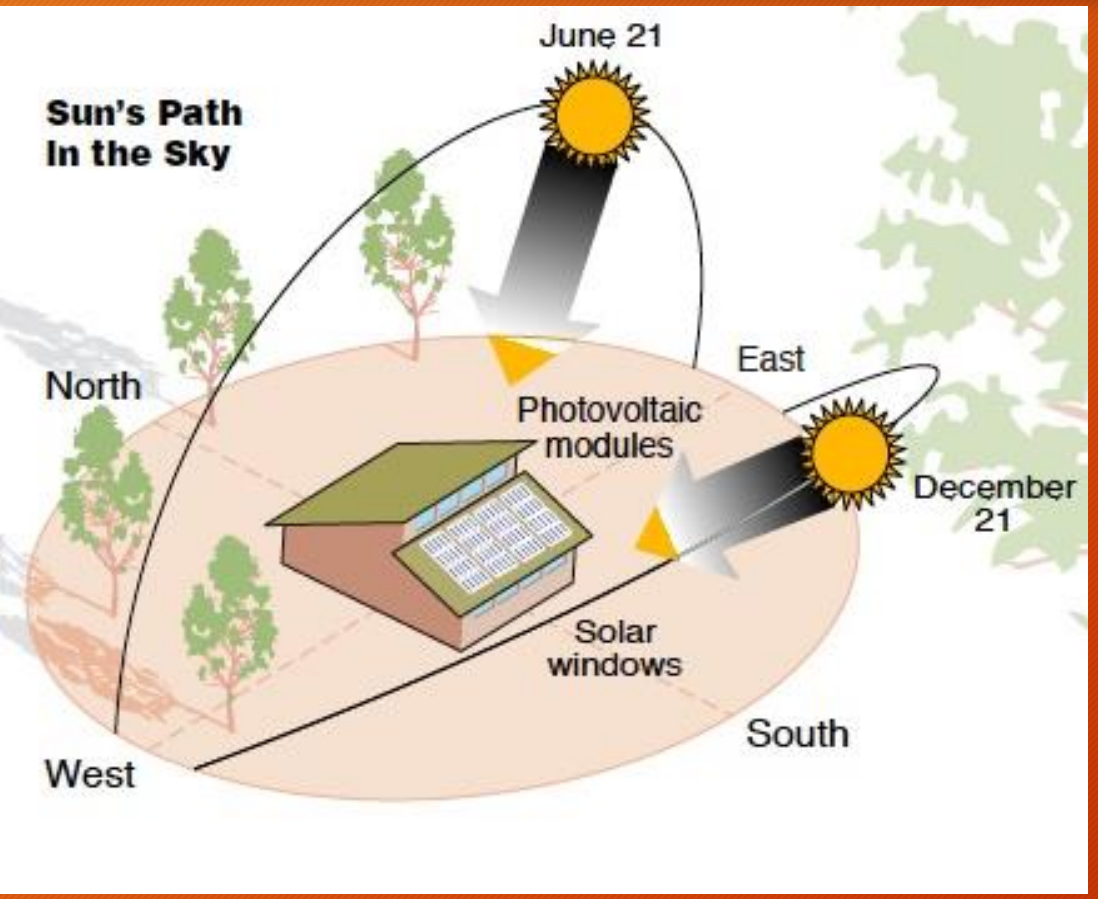
Building Construction – Orientation of Buildings
Orientation in Different Regions

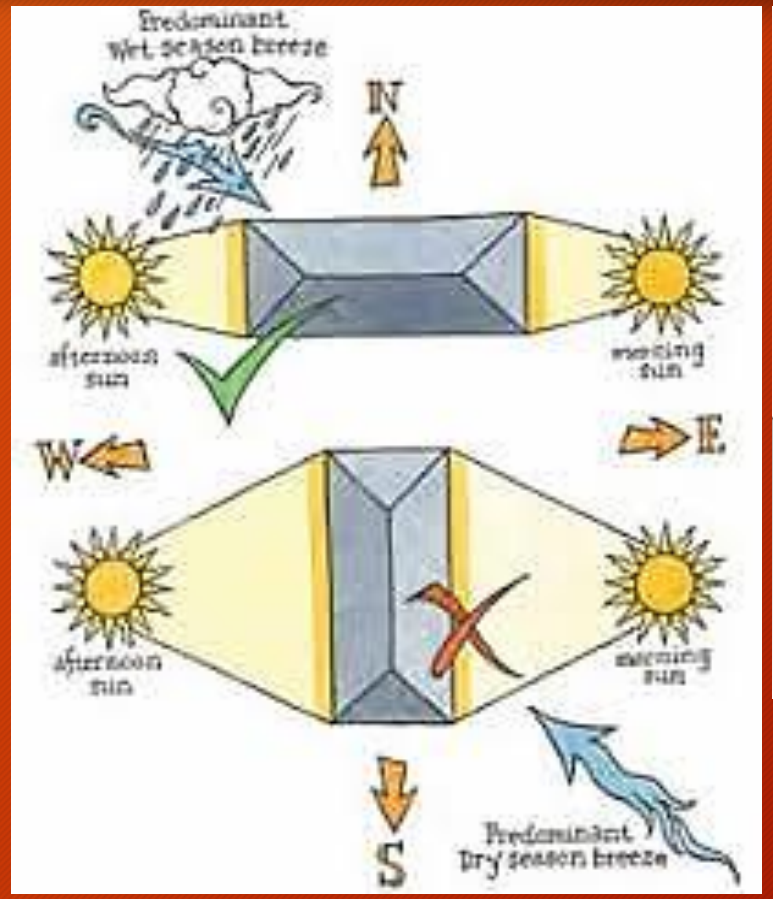
- The climatic conditions, intensity of sun, and the direction of wind differ from region to region. It is, therefore, not possible to follow a rigid method, with regard to the orientation of buildings.

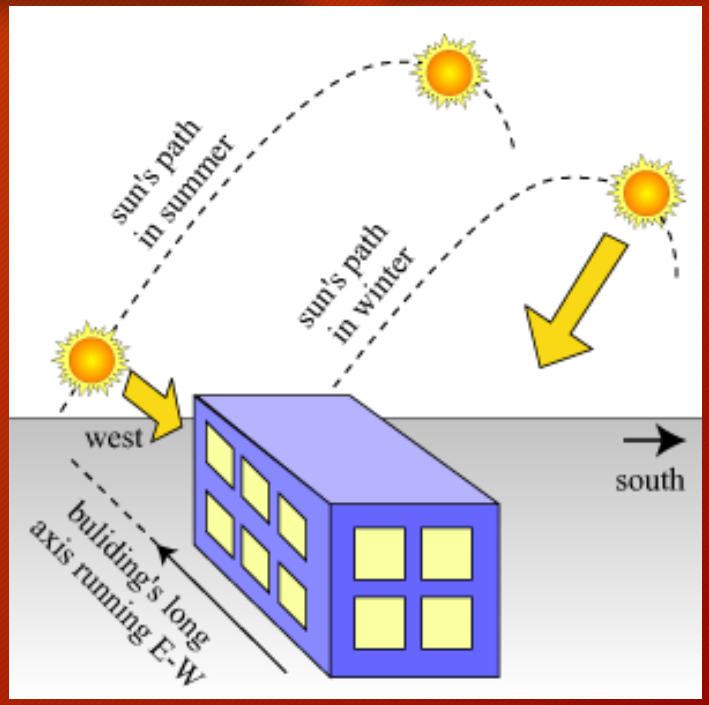
- In general, the **Earth's surface** is divided into **three different regions** with respect to the orientation of the buildings. In these regions, the orientation is discussed separately.

Building Construction - Orientation of Buildings

Orientation in Different Regions







Building Construction - Orientation of Buildings

Orientation in Different Regions

(1) Hot and Arid Region

- In these regions, the **climate is extreme**; the temperature ranges from **50C⁰ maximum** to **36C⁰ minimum**, or, more or less.
- Cloudless sky, low humidity, and high incidence of Sun's glare are the main features.
- The sunny areas are **hot and dry** in the day time and **cool to cold** at night.
- As far as possible, the building should be protected from **day time heat and glare** during summer and at the same time, the **rate of heat loss at night** during winter should be **reduced.**
- In these regions the building should be **oriented for the Sun**, not for wind as in humid regions.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(1) Hot and Arid Region

The following points should be kept in mind while orientating building in such areas:

- To minimize the heat gain during summer and take benefit for solar heat during winter, the **longer walls** should face north and south and **shorter walls,** east and west, so the least wall area is exposed to the slanting rays of Sun during fore noon and afternoon.

- In other words, we can say that the **longer axis of building** should run **east west,** so as to avoid excessive heat from west side.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(1) Hot and Arid Region

- Provision of **projections** on the southern walls will give sufficient shade to the walls during summer and provision of windows and openings on the southern wall will allow sunrays to enter into rooms during winter, because the Sun's altitude is high in summers and low in winters.
- **Verandahs** are desired on the south for protection from heat in summers and, also, for sitting out purposes in winter to enjoy the Sun's heat.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(1) Hot and Arid Region

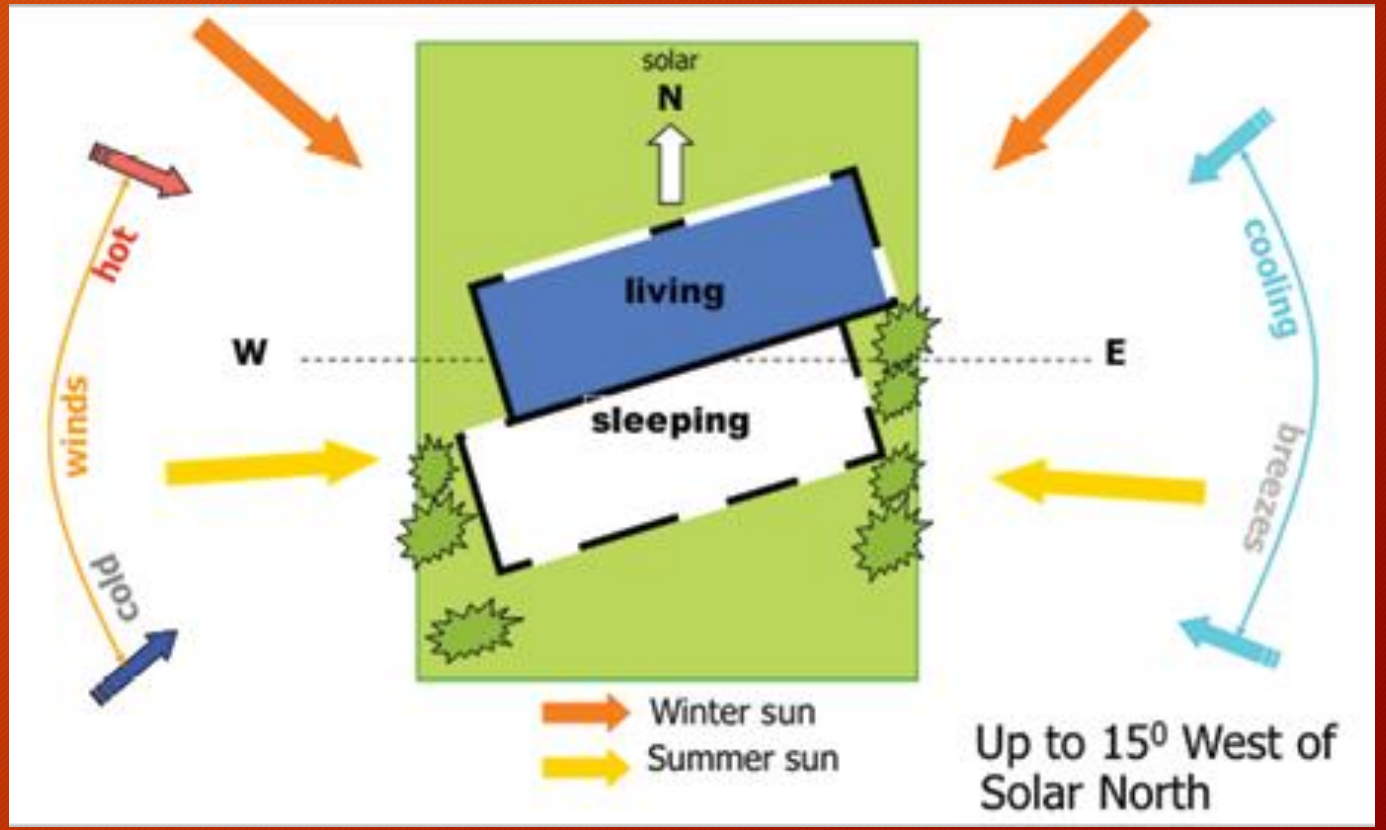
- **Openings** in the west should be small and should be properly orientated. (To save the cost of verandah on the west, the afternoon's Sun may be kept off by providing **Louvers,** which are ventilators, sometimes provided in windows also, in which horizontal sloping slats allow ventilation but exclude rain and Sun's rays.)

Building Construction - Orientation of Buildings

Orientation in Different Regions

(1) Hot and Arid Region

- A small **tilt** in the axis of the building must be given away from the west towards the south (facing near about north-west), to get maximum benefit of breeze during rainy season, autumn, and spring to ensure comfort and proper ventilation.



Building Construction - Orientation of Buildings

Orientation in Different Regions

(2) Hot and Humid Region

- In this region the climate is humid, temperature in summer is moderately high and rainfall is heavy.

- The prime object for orientation and design of buildings in this region is to provide free air movement through the building and to prevent the temperature rise of its inside surface above the shade temperature.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(2) Hot and Humid Region

The following aspects should be considered while designing buildings in these areas:

- The building should face the direction of the prevailing wind to obtain maximum benefit of the air movement.
- A **tilt, up to 45 degree** may be allowed, if required, for which the loss of efficiency is only up to 20%.
- **Window sills** should be low to ensure **maximum ventilation** at the normal living level.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(2) Hot and Humid Region

- Walls should be shaded from the sun, so as to prevent the temperature rise.
- Protection of openings against rain is also necessary.
- Building should normally have open planning, as far as possible. They should be of one room thickness, so as to ensure thorough ventilation.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(3) Hilly Regions

- In these regions, temperature is usually much low and cold dominates according to the increasing altitude.

- There is marked drop in the temperature during night.

Building Construction - Orientation of Buildings

Orientation in Different Regions

(3) Hilly Regions

The following points should be kept in mind while orientating building in such areas:

(1) The buildings should be located in the **southern slope of the hill**, as they receive **maximum sunshine** for the greatest duration of time.

(2) The opening should be placed as to allow sunshine inside the building.

Orientation in Different Regions

(3) Hilly Regions

(3) A massive structure with high heat capacity is useful because the heat, it stores during the day is welcome, except in very hot day.

(4) It is necessary to provide ceilings of good thermal insulation to reduce loss of heat by radiation during night.

(5) In areas, with heavy snowfall, the roof should be kept sloping to prevent accumulation of snow.

Building Construction - Site Selection
General Precautions in Selection of Site

Which Problems Occur due to the Water Logging?

Following problems will occur due to the water logging in foundation pit:

1. Difficult to further excavate further deep
2. Difficult to remove excavated earth
3. Collapse of earth from the sides of pit
4. Excess and continuous water will increase w/c ratio and will make concrete weaker or even useless
5. Difficult to work
6. Mud will enter, pit, mortar or concrete
7. Safety of worker

Building Construction - Site Selection
Water Logging – Case # 1

(a) When Surface Water is Encountered

- Surface water is not the major issue. Surface water logging can be easily drained out by **providing a marginal slope to the ground**. **Filling of the good soil** at the uneven surface can be helpful to overcome the problem of water logging
- Remember that water should be drained out before filling the good soil at the site.

Building Construction - Site Selection
Water Logging – Case # 2

(b) When Ground Water is Encountered

- If the water table falls within the depth of excavation, the depth of the foundation may be decreased up to the top level of water table, and the size of foundation should be increased.
- But minimum depth of foundation should be provided or foundation should be rested on good soil. By doing this you can avoid water logging. It is must to contact a well experienced structural engineer to check the feasibility of this kind of foundation design in such a waterlogged area.

Building Construction - Site Selection
Water Logging - Solutions

- In the waterlogged area or where water is encountered, the foundation work should be carried out in a very systematic manner. Foundation should be excavated one by one otherwise you will have to face this problem.
- Provide sufficient slope at bottom of foundation pit so water can be directed towards the sump which can be located at the corner.
- Remove water from the sump by deputing labors. You might have use **mud pump** continuously to drained out the water.
- Finish the RCC work of one foundation and then start the excavation of next foundation.
- If you start the excavation on the whole site, you mess up the whole area due to the water logging and you have to deploy the extra labors to do the activities like mud cleaning, frequent repairing of the muddy road, removing collapsed soil/mud, etc.

Building Construction - Site Selection
Water Logging - Solutions

- The higher working space should be considered while excavating the foundation pit. Higher working space will facilitate you to construct the sump and drain at the bottom periphery of the foundation. The drains collect the excess water of excavated pit and transfer it to the sump, from where water is drained out manually or by means mechanical pump (mud pump, anti-clogging pump).

Building Construction - Site Selection
Water Logging - Solutions

- Suppose you have to excavate up to 7 feet and water table is at 6 feet. On first day excavate up to 5 feet only so that water does not enter. Next day excavate 2 feet, **do sand filling/PCC and also do footing.** Keep everything ready for doing that fast. Idea is to complete the work fast, so that water does not accumulate in large quantity. If needed run pump all throughout work. Repeat this process one by one for each footing.
- **Add lime** in the bottom 1' 0" of muddy soil, rather than excavating it and when it is difficult. Stabilization of soil with **2 to 5 % of lime** will help to **stabilize the soil** and **reduce the entry of water.** You can also use cement, fly ash, aggregates, etc. to overcome the problem of water logging. In the case of higher water pressure, the soil stabilization will not be effective and suitable.

Building Construction - Site Selection
Water Logging - Solutions

- Sometimes **sand** is also **sprayed over the muddy surface** in the layer of 100 to 200 mm thickness. Sand layer **filters the mud** and allows clean water to enter in the pit without higher flow. This provides mud free platform to work in the foundation pit. We very well know that working in fresh water is far better than working in the muddy soil. You can do immediate PCC over it. By doing these 2 layer, you will automatically come 150 to 200 mm above where water may perhaps not come.

Sand Sprayed Over the Muddy Surface

Building Construction - Site Selection
Water Logging - Solutions

- In case of groundwater with high flow, make a layer of PCC 1:3:6 or sand 250 to 300 mm.
- There are different methods of dewatering that are used to remove the water from the water-logged area. We have already discussed the different types of dewatering methods and their use in construction. **Generally, these methods are expensive for small work.**

Building Construction - Site Selection
Water Logging - Solutions

- Constructing a foundation in a waterlogged area becomes hassle free when you know the aforementioned tips.
- Generally, water is not a big problem, it is the **mud** that bothers everyone. Water can be easily drained out with the pump but the mud causes lots of trouble. Sometimes even mud pump also fails to drain out the muddy water from the waterlogged area.

Building Construction - Site Selection
The Foundation in Black Cotton Soil/Expansive

- **Alternate wetting and drying of the soil** is not the favorable condition to rest the foundation. i.e. Generally, the water table is high during monsoon, and it gets lowered during the dry season which causes the uneven settlement of soil. This uneven settlement of soil badly affects the structure.
- In such case, rest your foundation at the depth where the **soil is either completely dry or completely wet**, so that it is safe from alternate wetting and drying. So, decide your level and foundation accordingly.

Thank-you for Listening!

To become valuable, start delivering your services above your salary!

(Shad)