Climate and Built Environment

Lecture 10

Hot and Dry Climate

This is different climatic zones in India and hot and dry region is usually located here air temperature during the day timeis between 43 degree Celsius and 49 degree Celsius at night.

During the cool season is between 10degree Celsius and 18degree Celsius. During the dry season it is between 27 degree Celsius and 32 degree Celsius and humidity. Relativehumidity (RH) is low from 10% to almost 50%.

Relative humidity is very less whichis why it is called as dry and the add temperature is veryhigh. This is the combination of higher temperature and lower relativehumidity iswhat make it as a hot and dry climatic condition.

Usually typical example for this type of climate is Rajasthan, jodhpur, Jaipur, Sahara usually the places in which find we find deserts and the vegetation is very less due to reduction in relative humidity

Design Recommendations: Architects main aim is to avoid hot sun as far as possible.

To capture as much cool air as possible.To provide protection from dust storms.

Even thoughRelative humidity is very less and the temperature is very high the wind velocity that is found in this type of climatic region are very high.

Due to reduction and relative humidity the sand is usually very dry and the air is filled with dust and fumes which gets transmitted from one location to other due to high amount of wind speeds. We need to take care the sun is avoided and also the presence of dust in the air.

As we see here,there is very small opening that is present it is not only to reduce the air temperature are solar radiations it is also reduce to the dust that is coming from the wind that is flowing in to the building.

External look is almost dead to avoid sun.exterior is light in colour again to avoid absorption of heat.surface area exposed to sun is minimum units are embedded deep in to ground.thicker mud walls act as good insulating materials smaller size of windows limits glare of solar radiations streets are narrow units are very closely

placed.so these are some of designs. General design recommendations that we usually see in hot and dry climate condition.so your wall has to be placed in such a way that it has to avoide the ingrus of solar radiation in to living spaces. You need to reduced your opening sizes also.you need to reduce your opening sizes and make your building is locate close to each other the mutual sharing can happen and the spaces in between can be avoided from any type of solar radiation to fall inside.that is one of the main considerations also we can paint the exteriors in much lighter colour such as white to avoid the absorption of heat on your wall surfaces and thick a mud walls act as a good insulation materials because of the high thermal mass which reduces the fluxuation of daytime temperature and night time temperature presence of mud will absorb the cool temperature during the night and when the temperature outside is very during the morning time that cool temperature that is been absorbed from the walls of the mud material will start to decipate to the interior spaces so,if your using wall structure eventhough the outside temperature is very high your interior temperature will be much more cooler almost 12 to 15 degree Celsius due to presence of high thermal mass,presence of choosing your opening placing your aperture is and type of colour walls and window locations and previling everything becomes very much essentials in this type of climatic conditions.

North-south orientation best suits for this type of climate as it protects from morning and evening solar radiations after say 11’0 clock when sun starts to rise above it start just to come start top of this location and east and the west location is where the sun start to move that is the direction in which sun is going to be for the maximum time. Keeping your building orienting towards north in south is much more suited for this type of climate because it will reduce the instant solar radiation that is falling on your structure. Apart from this local site condition and its surroundings also plays major role in deciding orientation. we cannot choose always south and north orientations if your having a site in which there is lot of building very closer to each other that is your site is completely shaded already then we can go for any type of directions because already a your site is not receiving any solar radiation to block in the first place we need to know above the orientation of surrounding buildings as well to provide a best design or best orientation for your structure bedrooms should be oriented to receive cool night air. Since bedroom spaces are the one which is going to used after the sun hours so these type of spaces is has to be located in such a way the night time temperartures in these location are very much lower.take advantage of such cooler air or cooler

breeze bedroom has to be oriented to take the priviling wind directions during the night times.compact plan are preferred as these will expose minimum surface to harsh solar radiations.rather going for elaborate plan going for smaller plan or compact plan is much more appreciated in this type of climate.because it reduces your exposure towards your sun. so imagine if your designing a huge space all your surface areas going to get exposed to external your harsh conditions and it's going to absorbed a heat energy where is if your going for a compact or smaller plan when the surface area itself to reduced. So instant solar radiation is also going to get reduced which is going to reducing or elevating a indoor temperatures compared to the external temperatures deeper rooms are better against hot outside solar radiations. So going for deeper rooms if you are having opening a oneside you have to design in such a way the usuable space is to be completely without the instant solar radiation of or sun energy which is going to come through the window if you are happening.we cannot completely avoid the locational windows through the windows for our day lighting and also to remove the stale or used up air or else your placewill start to have fowl smell inside remove the stale or used the air space to start the air fills inside,inorder to take out all these to have good amount of day lighting you obviously need windows but you need to position it an optimum level it doesn't disturb or elevate your indoor temperatures. Inward looking plan best suits for this type of climate as these straight away protect us from external solar heat and radiations.you need to locate your building say if you are having a smaller coated design in that loacate all your structures looking towards a coated because it will start to take away the hotter,due to the presence of coated the cooler that is present the ventilation systems can be design in such a way the cooler can it be drawn it can be made to flow through the user will spaces.

House plans: Compared to this type of structure where you are keeping windows here on this room form window is going to take up the sun energy atleast throughout your structure whereas you go for deeper plans window that has been located is much more narrower wall compare to the other orientations here the x wall is much shorter dimension compared to this y side which will protect sunrays which is been falling inside your room so this part is to be completely without any sun the air temperature will be comparatively lesser to the first orientation this type. courtyard planning along with some trees and small water body creates very good cool microclimate as evaporative cooling effects occurs in this type of courtyard providing water bodies must appreciated in this type of climate because the relative humidity is just between 10 to 55%.Incase how a need to improve the

relative humidity to feel much more comfortable.if your air is completely dry also you will feel very harsh and your skin becomes very dry also and it starts to crack avoid all this you need to eventually improve your relative humidity.that can be done by providing good amount of vegetation providing a small water body because these are some of the examples you find palaces such as rajasthan, jodhpur a huge waterbody which is called as mountest which is located just around the palace the hotter which comes inside your palace through privilingss cooler and the relative humidity gets higher due to the presence of the mode and then the cooler air to circulated inside your spaces.so this is the same structure which can be adopted even for individual residences by providing courtyard is in smaller waterbodies in around your site.thicker externals walls with minimum windows should be used to avoid heat and solar radiations.so your wall has to be thick compared to any other climatic condition ,inorder to avoid the penetration or heat transfer that can happen from this exteria to interior space.Heat producing areas should be separated from otherareas of house it is very similar to warm and humid climate.in this point in wwhich we need to separate kitchen and bathroom areas from other living zones and bedroom in order to reduce the heat transfer happen to kitchen to a living spaces. Next to Roofs: Roofs should be insulated from hot solar radiations. Thicker insulating materials should be used for this alight coloured or totally white terrace surface will reduce effect of hot solar radiations.providing insulation becomes essentials for hot and dry climatic condition atleast we need to have minimum number of insulation for this type of climatic condition roof we must also provide ventilation roof to take out the hotter also the roof can be made to be much lighter colour are reflect to tiles such as pure white tiles can be used which can reflect the almost 60 to 70% of the insulant solar radiations back to environment rather than making a penurate inside your spaces and creating discomfort for the optimums. Roofs should be made hogher so that radiations from ceiling is less harsh and there is enough space for hot dicipated air if the volume of this spaces has much more higher compared to the other climatic zones because as we discussed the hottest star to raise above if you are having room of height 9feet or 10feet and hotter start raise above that actually just revolving around all the time but if your creating a huge room with the height of 13 feet or 14feet and the hotter start to raise above it much more higher than occupend usage levels so this also creates a pressure difference higher pressure zone and lower pressure zone which will make the wind to move lower pressure zone to higher pressure zone.

The walls of day time living areas should be made of heat storing materials so that these can store heat in day time and keep the inside cool and radiate back in to atmosphere during night .Since we have the advantage of cool and nights and only the days are very hot we need to design each and every element in such a way it take advantage of cooler air and it can be stored inside the place during the hot day time the cooler air which has been stored because of the cooler temperature it will be circulated inside we need to go for higher thermal mass materials for wall systems compared to any other climates. Eastern and western hall should be shaded with trees or some other screens providing some type of solar screen or vegetation to avoid the ingrus of solar radiation western east side becomes very essential these two other sides which is going to have more solar radiation or more solar instant radiation. Double wall construction with proper ventilation may also be constructed on western side.keeping a double wwalls say for example first wall is the wall which is going to be actually connected to a interior and there is a small airs gap between provided and again your building a wall it is just to avoid a instant solar radiation from western your wall this is similar to provide a structure we saw in earlier presentation warm and humid climatic condition.

External openings should be small eastern and western side windows should be protected by trees. Large glass areas should be avoided.Deep sun shades are required to shade windows effectively.it would be more effective,if we some how,separate our sun shades from main structure.Windows sill should be higher to provide dust protection so these are some of the opening constraints has to be considered it reduces the ingrus of solar radiations or also to reduces the ingrus of dusty wind storms to inside your spaces ,so you need to keep an optimum shade to system such that daylight is not completely taken away incase your having a window completely shading a system which is going to reduce the ingrus of daylighting the space become very dark eventually is going to use external artificial light systems again to contribute the heat of the interior glows so that has to kept in a optimum level so these has to be balance accordingly your latitude and longitude sun is moving.

Interiors: Light cool colors should be used for interiors.Surfaces that may reflect radiaions should be painted dark to reduce glaring effect.

Exteriors: Dark surfaces should be avoided as these would absorb heat.light coloured/shiney reflaective surface should be used to reflect solar heat.provide as much green surface as possible as this will cool the surroundings.for the both

interior and exterior time consideration is to reduce solar energy but also you need to keep in time there glad that is been produce this type of climatic conditions very high. So keeping reflective surfaces everywhere also can cause accidents it can elevate to glare to great extend you need to choose a material such as your glare is always to control avoid hard paved surfaces as these may create glare and radiate heat inside the building ,on the exterior you need to avoid building halfscape pavements ,so rather going for halfscape payments going the combination of halfscape it will reduce the effect of glare provide a balance in your designs the glare or accidents should be reduced

Design /Planning Concepts

Exterior hard paved surface has to be reduced because of its going to absorb the solar radiation and it is goin to divert your inside the spaces so if your keeping softscape or vegetation the

Instant solar radiation are going tto absorb the vegetation and its going to be actually going to the air cool that is presents and above it,Awell protected in ground building fights better this type of climate. As you see here this building embedded inside since the building is surrounded by cooler vegetation or ground cover. The temperature of the interior spaces and maintain a constant grains rather from being a hotter days and cooler nights due to the some construction techniques or materials used for hot and dry climatic zones concrete hollow block. Hollow block construction technique also help in thermal insulation of buildings since there is an aircavity is present within the block itself that is going to trap the air inbetween and it is going to reduce the heat transfer between exterior spaces and interior spaces could not be avoided completely and taken to the heat to transfer exterior to interior and it can be increase so that time can be timelag for this material is much higher for compare to conventional break systems and double roof technique protect main structure from solar heat as your absorb in this structure. This is your main structure there is a roof that is happening aboveit.since it is a metal roof which has reflective surface the instant solar radiation that is falling on the reflective surfaces. Surface is going to reflect completely or almost 70 to 80% so remaining 30 to 20% which comes in between the air gap as a wind moves from this point to here the heat transmitted from first roof is going to further removed away & only very minimum & very normal amount of radiations to get transfer in to a actual structure so providing a double roof structure very much appreciated for this climate condition now moving on to cold climate.

Cold climate: These are some of the examples of cold climate is kodaikanal,ooty,jammu &kashmir ,layladakh some of the examples in which the temperature is very low it can go till zero degrees a mean average temperature throughout the year this type of climatic conditions 10 to 15degree Celsius relative humidity is comfortable with in the range 60 to 75% of relative humidity.wwe need to design a such a way instant solar radiation can be use beneficial for this type of climate as well as occupancy to be used. So this type of objectives:

Resisting heat loss: Decrease the exposed surface area of the building

If your increasing the solar surface area of this building this again it is contribute to heat loss the main important strategy is this type of climatic condition trap the heat within the space if your building is exposed to the sun your going to heat up the air the hot air has to be trapped and it should be let to escape outside so if your letting the hotter to go outside then again your space become cooler and you depend on room heaters near the source of heating methods to avoid this you need to have window or aperture in an optimum balance it has to be taken the heat as well as it reduced your heat loss. Using materials that heat up fast but release heat slowly this is one type of such cases using carpets this is why we find carpet flows in foreign region in which carpets which absorbs the heat quicker and releases it slowly it in a space which has been room heat is been provided so if your using the carpet the heating that is generated from the room heaters to get absorbed by carpets and directly we in the contact of carpet much more comfortable eventhough the add temperature is much colder or below the thermal comfort providing before the buffer space between the living areas and the outside ,so rather than keeping your living space is directly in the contact within the outside keeping suns like sunspace or sun room in which we discussed in earlier presentations in which the room is completely made out of with glass instant solar radiation is made in to fall in the sun space and the sun space get heated up and the hotter air is been taken and circulated inside. This is the typical example we usually did find in foreign location such as U.K and U.S. We can see a glasses effect in added to a living space a garden or plantation as grown and it also become a outdoor extend space with all the protections.decreasing the rate of ventilation inside the building incontrast with hot and dry climate warm and humid climate you need to reduce the ventilation because t further contribute to reduction and cooling. If subjected to flow of air current you already in a cooler region. So, air starts your cooler body you feel much more colder so you need to avoid such type of current that goes across your body or across your usable spaces

not only for interior but also your exterior because when your panning the trees or urban places we also keep this also in your mind.

Promoting heat gain: Avoiding excessive shading utilising heat from appliances.

Inthis type of climatic condition we need to reduce or make the shading optimum only to reduce the harsh summer rays but during winter or prolonged cooler seasons you need to take advantage of instant solar radiations so,having windows in such a way it let in heat it will reduce the heat loss and also having the electrical appliances inside gone to contribute to space heating. It has to be stored within the place it will be used for additional cooling element trapping the heat from the sun which is also the primary important for this type of climate.

Site: Landform: In cold climates heat gain is desirable.Hence building should be located on the south slope of a hill or mountain for better access to solar radiation.

Exposure to cold winds can be minimized by locating the building on the leeward side. You need to avoid your windows on the wind side because then you are keeping the wind side is going to come inside and further cause discomfort.so,you need to keep in this mind and also your opening should be located on south side.In sucha way the sun moves from east to west towards the southern side with the region in this type of climate condition.southern hazard is going to have more solar radiation.

South has to be exposed more parts of site which offer natural wind barrier can be chosen for constructing building.so,as we see here this is southern side and this has been located in such a way will take advantage of solar radiation and also we need to keep in mind to avoid previling winds.

Open spaces and built forms: Buildings can be clustered together to minimize exposure to cold winds. To reduce the wind to coming inside your open spaces build your wall can be closed to each other. The flow of cold wind can be avoided but also it will reduce the penutration of solar radiation , this has to be only in optimum level only the solar radiation come in and wind should be avoidedyour prime important is to increase. So you can go for external vegetation and external wall structure for divert your wind direction but your prime importance to increase the instant solar radiation. Open spaces between buildings must be such that they allow maximum solar rays to be incident on the building. This is what I have just explained it has to be such a way has to trapped more of solar radiations. They should be treated with a halt and reflective surface so that day reflect solar

radiation on to the building it can be made some of the reflective surfaces can be use in such a way instant solar radiation is actually diverted inside your interior spaces rather than being reflective outside clustered building sharing walls to reduce exposure to cold winds. As we see here these are clustered buildings which is been kept close to each other but this spacing between two buildings is kept in such a way the solar radiation will fall inside and this pavement can be made out through light coloured smooth paving which will reflect the instant light rays inside your usuable space.

Street width and orientation: In cold climates, he street orientation should be east-west to allow for maximum south sun to enter the building. The street should be wide enough to ensure that the buildings on one side do not shade those on the other side.you need it to keep in such a way have to avoid overshadow of the buildings. So building has to be kept faraway from each other. In such all clear ground having a good amount of solar radiation.