Fire Protection, Services and Maintenance Management of Building
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Lecture - 11
Fire Safety: Urban Panning

So we will continue from where we stopped actually. So, we actually last class you are looking at I will just giving you the concepts of neighbourhood.

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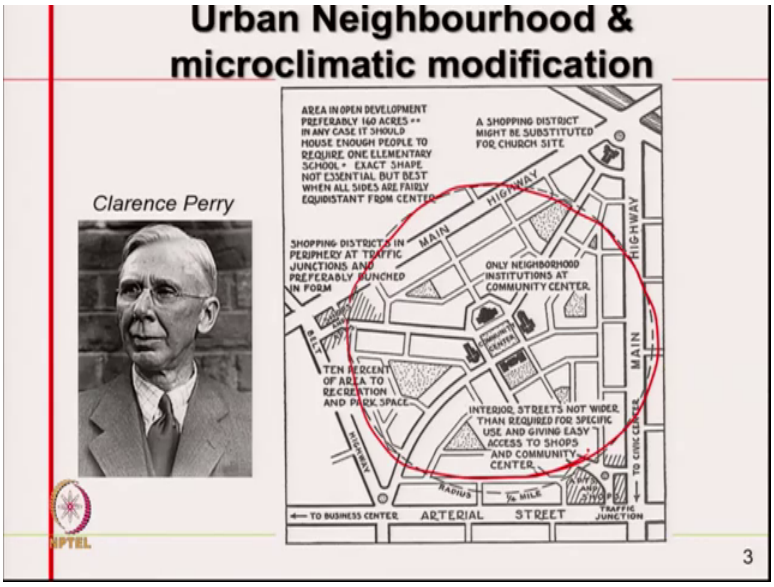

Neighbourhood is the smallest unit in urban residential you know planning, a residential unit actually planning unit. So, whole thing was this was this actually concept is very good actually, if you look at it; this was given by Clarence Perry 1925 which I said in the last class. And this is what you know; this is what constitutes an urban neighbourhood planning. Now inside this neighbourhood the planning for fire protection is important.

Student: hm.

Right we will come to that sometime later on for example, street planning. Street planning should be such that one thing no thoroughfare, no heavy vehicles passing, but there should be provisions for fire fighting vehicles. So, this is one issue, which we will should look into it. And the main focal point of such a neighbourhood plans were essentially the primary school.

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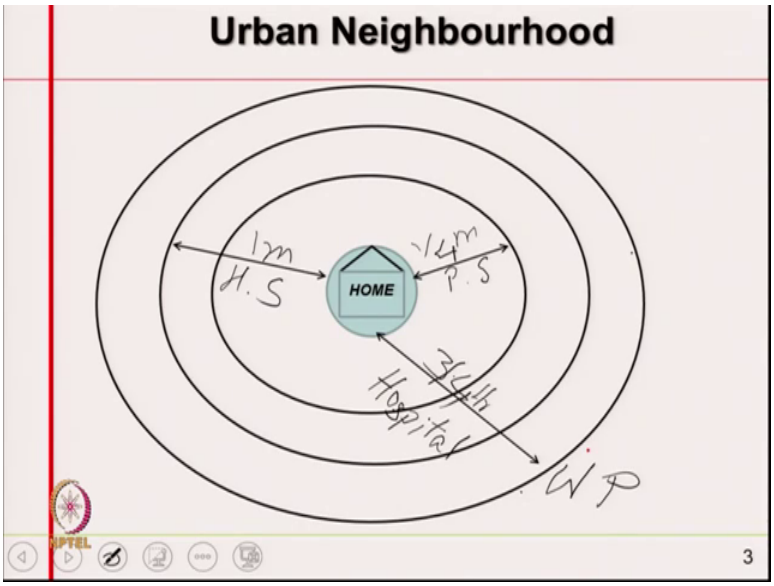

Because from home the primary school should be about one 4th of a mile that was his concept, which would mean around point 8 kilometres right. And there should be P S stands for primary school and children should be able to walk on their own, and reach there.

And then high school should be about 1 mile and the workplace or hospital there should be around 3-4th of a mile 3 4th of an hour travelled by highway or roads that is the thing. And then you have recreation etcetera one and half hours and so on family recreation something those kinds. So, that that is what the concept of urban planning actually.

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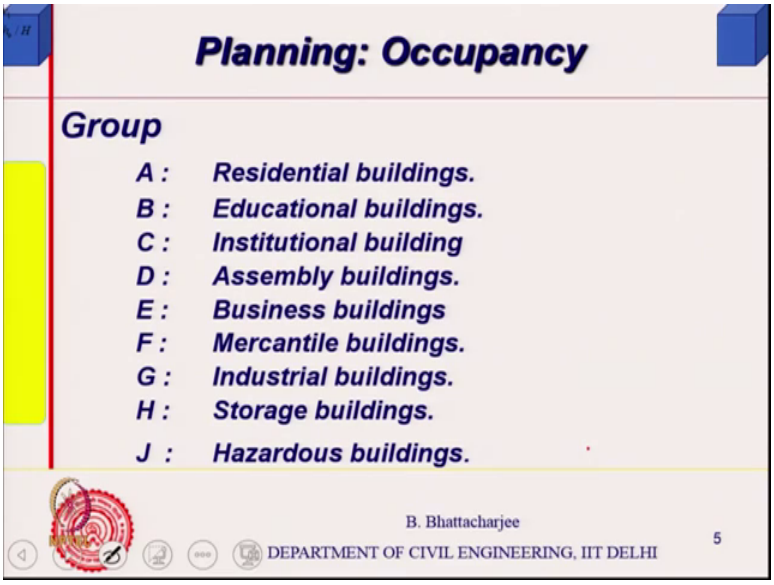

So, obviously, you find them urban plans would or any planning would include different types of building what you call as occupancy, occupancy classes types of occupancies. So, this is what national building code groups them residential building: group A educational building, institutional building, assembly building, business mercantile, industrial storage and hazardous A B C D E F G H and then J I is not there.

So, industrial already is G so hazardous building. Now you can see that all kind of you know functional designs of building. They have some relevance to urban planning itself. It starts from urban planning. For example, designs for you know thermal comfort or energy efficiency, the clustering of building will good in certain type of climate while it should be spreaded from one another because you need a lot of ventilation where humidity is high, north eastern states in India.

Let us say or coastal areas humidity is usually high. You will find the buildings are space (Refer Time: 03:28) while in Rajasthan or Haryana, those areas you will find they are clustered. So, traditionally, but otherwise also there should be because mutual shading etcetera. So, you know planning starts from there itself for noise in keep noise sources away from noise sensitive areas.

So, residential areas are noise sensitive traffic major traffic should be at the periphery there should not be inside or industrial zone, which actually might generate lot of noise should be away from the residential zone. Maybe there are buffers inside like green belts and so on. So, to urban planning itself fire provisions or any other planning for that

matter for example, the space between 2 buildings should be at least 6 H for ah if they are if they are you know, you just in sort of facing each other long of wind direction.

So, that there is no the wind flow around the building. You know you have sufficient ventilation wind movement is there air movement around the building is it appropriate. So, these are the other aspects as far as fire is concerned similar sort of thing.

So, sensitive for example, hazardous buildings are can generate fire. And some those occupancies might be very sensitive to fire, there can be catastrophic failure deaths etcetera fatalities. So, you keep the sensitive ones away from the fire likely fire generating or hazardous, fire hazardous buildings.

So, zoning is done right away at the urban planning stage. So, national building code defines zone 1, zone 2, zone 3. And some of those occupancies will be in zone 1 right and zone 3 would be somewhere there and there should be separated also. This is this first part of the planning. This is first part of the planning.

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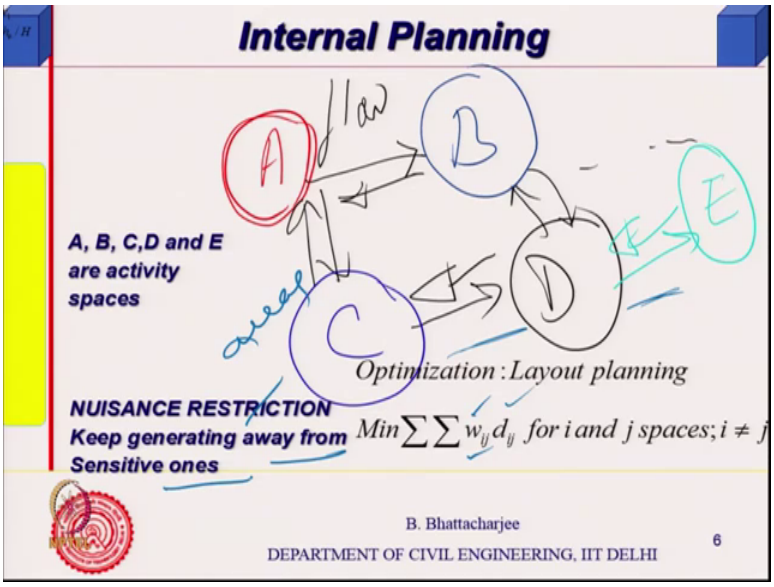

The other aspects of planning which I did not really did not tell you ah, but much see the planning actually is done for minimal traffic flow.

So, supposing this is a activity space room you know activity space means room for example, in an academic building it will be classroom teachers room etcetera. In residential building this would be possibly living room, the other could be kitchen and

then bedroom and so on. So, the traffic flow between them is very much considered. Traffic flow between various buildings is considered various spaces are considered not building various spaces.

in an in an in an area a state planning you might also try to see minimize the traffic flow, traffic movement should be minimized; that means, what; that means, number of people multiplied by the number of movement, frequency of their movement in a given period let us say weekly. In a hospital building for example, number of times.

Student: (Refer Time: 06:18)

So, doctors move because doctors are paid salary. The nurses move, any one patient movement though all though you know. So, generally there is a paper in 1967 by whitehead and elders which talks about computer or you know computer aided layout planning of single story building. So, there the traffic movement is minimizes, it is an optimization problem, you can solve it this is solved by heuristic ways. So, basic idea is that you try to make traffic movement.

Student: minimal.

Minimal so moving from one classroom to another, it should not be spending too much of a time, otherwise it is a wastage. Even the teacher should not be spending too much of his or hard time from our office or his office to you know lecture room and so on. So, that is how it is minimized and this an optimization problem can be solved, so this is one issue.

But the other issue together with that traffic is one issue, but other issue is nuisance restrictions. For example, in academic institution workshop would generate noise, classroom is noise sensitive. So, you cannot keep workshop next to the classroom. If you keep then, you have to provide high insulation. Similarly, the any within the within the building the one which can generate fire should be kept away from one which have fire sensitive, but then if generally fire means kitchen can also generate fire.

You cannot keep it away from the other space in the room the other constraint comes into picture. So, idea is that when there are nuisance restrictions you try to keep the sensitive one away from.

Student: (Refer Time: 07:54)

Generating one, some activity spaces are both nuisance generating and nuisance intolerant. So, such 2 space of similar kind cannot be you know those ones cannot be put together. While one which is not sensitive to any kind of nuisance fire, order etcetera hazard or nuisance, they not sensitive neither do they generate deputy in everywhere. So, in planning stage within the building or in urban planning stage all issues functional design issues going. And fire is also one of them right.

So, these are activity spaces as I said every CD's are activity spaces and you can do the optimization of layout planning for minimization of the topic. For example, I J spaces I is not equal to G weighted, some sort of weightage multiplied by their distances some total must be minimized with any constraints those are there.

Now this weightages could be simply doctor salary per week for the number of doctors will be travelling right;the frequency number travel multiplied by their salary nurses travelled salary etcetera, etcetera; one can device them in appropriate manner right appropriate manner. So, this is generally general concepts of function planning and which applies to all including fire. Keep generating ones away from sensitive areas that is what I saying; generating areas away from sensitive area that is the basic principle.

Ok I am discussed too much about general planning, but let us go to the fire back.

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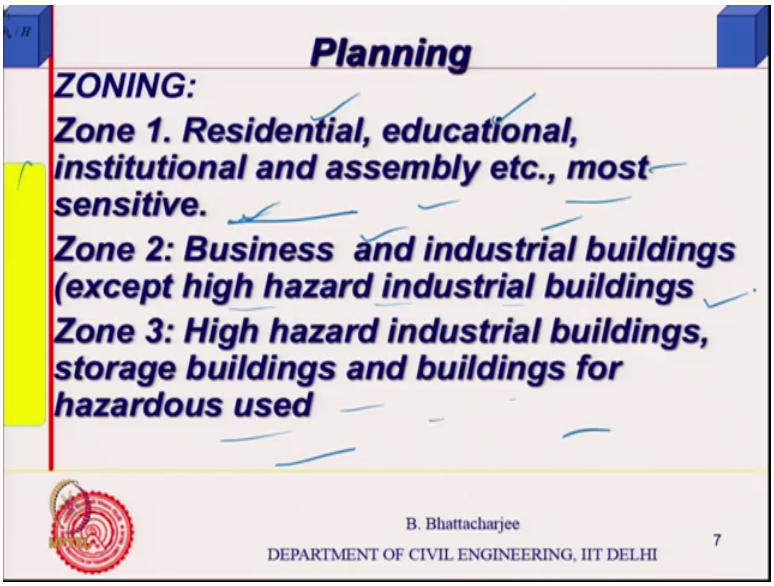

So, fire as I said zoning is done, same ideas in urban planning within building I will talk about urban planning, then within building for any kind of nuisance. Now in urban planning also zones once a residential, educational, institution, assembly etcetera, they are more sensitive and zone 2, business and industrial building except high hazard industrial buildings. Zone 3 are high industrial buildings, storage buildings and buildings for hazardous used. There should be kept away from each other and, you know you segregate them. Do not mix them up together; do not mix them up together. There are somewhere in between some of them can generate.

You know some of them can generate some of them maybe even sensitive to fire. So, they are in between and you can use green zones, buffer zones etcetera in between also. So, this starts from planning stage urban planning stages itself, this is what national building code gives you zone 1, zone 2, zone 3. Zone 1 is a sensitive one, zone 3 is could be very hazardous from fire point of view right ok. So, this is one aspect.

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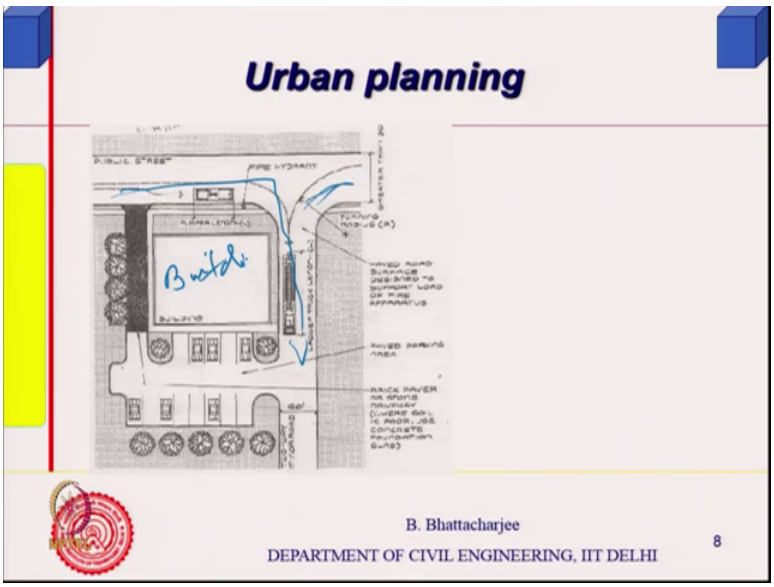

The next aspect is planning around a building with respect to fire right. For example, you must have sufficient space for fire fighting vehicle to move about. So, this is your building right? This is your building the fire fighting vehicle must be able to move freely about it and there must be adequate space for a standing. Their length can be very there can be length can be you know they can vary depending upon the location, the city fire administration what kind of vehicle there.

In a small town it would be it would not have that kind of you know bigger vehicle, which will have kind of leathers articulated leathers. It might to may not be carrying those, but in bigger towns there would be of those kind. So, whatever is a dimension of that and they should be able to take turn freely. So, the turning radius should be available for all fire fighting vehicles right, all fire fighting waves.

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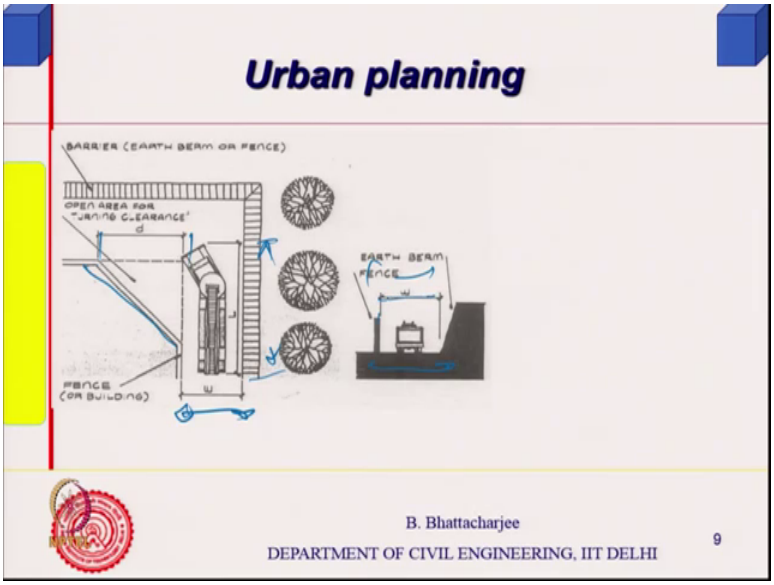

So, this is this is one aspect, so street planning is done that way. So, minimum dimensions are specified, this width, then this D right. So, this is at there you know because minimum width require, depending up on the L length; depending upon the length I must have depending upon the length of the vehicle this would say provided, so that there is.

Student: (Refer Time: 12:09)

It can freely take turn right and you can expect that during the kind of emergency then all not unlikely to reverse and go around. This very difficult it is impossible because it is the type of emergency also. So, this street planning should have adequate width, adequate turning distances is the national building code gives you those values.

So, values of L you know for values of W and D for various Ls. Literature also gives you for example, the one of the references which I mention is, you know gives you these values actually, I think I have forgotten the name anyway.

This mentions these are in the reference actually. So, this mentions actually David Egan, David Egan books. In fact, this diagram is also taken from Egan's book. So, you know, so Egan's book gives you all this kind of diagram for American situations, but national building code of India, but for it gives you these dimensions.

Also this width must be free, no wall nothing, no even kind of electric poles or anything of that kind no obstructions. So, free space W this is also define you know it should be minimum same W. So, it should be absolutely free.

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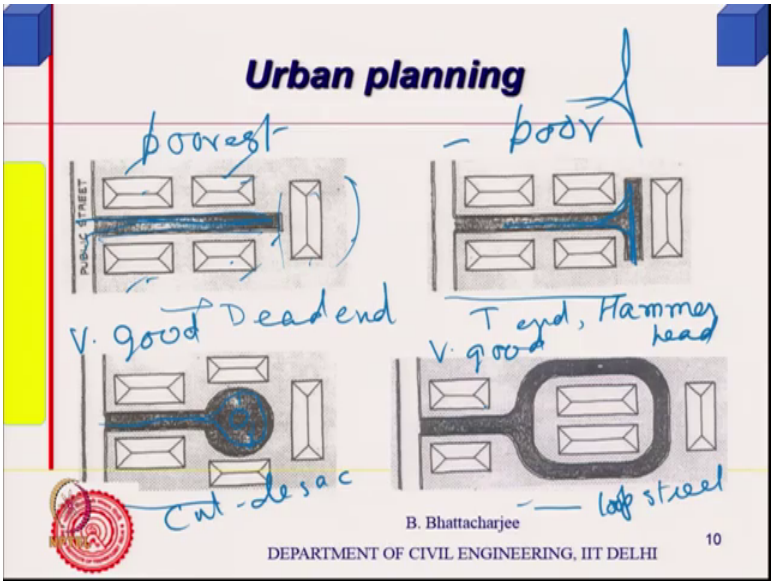

Then very important issue is this, while you have doing urban neighbourhood planning. You see you can have what is called a dead end street. This is a public street which is meant for all traffic, all traffic means; say let us say within the IIT campus right? Now there are residential areas there are residences, residential some residences are residences they are here. Now here what you mean by Public Street is the street which is meant for number of residences.

Student: (Refer Time: 13:59)

While this is the private street; meant for only these 5 houses this 5 houses right? This is a dead end street, this is what is called T or hammer head. And this is what is called a Cul de sac you have a roundabout here. And this is what is called a loop street right; I think

this is mentioned here. So, not mentioned here no not really, so this is called dead end; road dead end.

t end or hammer head, this is Cul de sac, where you have a roundabout might have a garden in between. And this is Loop Street, now this is not good, this is a poorest poor; good, very good, in fact very good, why? The fire fighting vehicle cannot reverse. So, the dead end street is a problematic thing, but the issue of urban planning of street there are another issue.

It is not in the fire the traffic privacy, traffic privacy you know traffic privacy means this; you should not have traffic thoroughfare through the residential areas or areas where you do not want it. For example, in IIT campus you do not want outer traffic to come in. So, there is no thoroughfare, but when you go to few residences also, there should not be because this is likely surfaced.

And I as I said it should match with the topography as much as possible. So, car brown looks nice they consume more space. So, when lot are actually set out, streets are also set out simultaneously in an urban area. So, there should if curvilinear once looks good if it matches is the topography a little bit or you know elevation down etcetera. It should match in the topography with least cost, you make curvilinear route too much of cost should be involved, but when it comes to residential areas both traffic privacy as well as fire fighting provision must be looked into.

So, a fire fighting vehicle you do not expect it to reverse this way therefore, this is very bad. This is not good, but old days you will find that this is there, let us say in IIT campus some of those place you will find them there is a dead end road actually. Originally they may have left spaces on this side no building on the side, spaces on this side, but, but when later on something was planned it might have happened, there is places spaces some places you can see new campus you will find this is a dead end.

So, this is not a good one in case of a fire, but fortunately the houses that abuts on to these roads in IIT campus they are all showed it; is that story height is more than you have more problem related to this. Hammer head is you know porous this is somewhere better, but it will have to reverse, the fire fighting vehicle it will reverse from here. At it will go like this rivers this is not very good again. So, you do not want reversal, a Cul de

sac is one where if you keep the sufficient radius it can just take roundabout and turn and come back.

So, this is the best and loop street also same thing you find them in Delhi in many places. In fact, you find many places you will find some loop streets in the Lutyens Delhi or some places in the New Delhi area you will find them. You also find Cul de sacs in some of those areas in, but then they consume more space, space consumed is very slightly you know latest plane. So, this is important from fire fighting provisions also from the fire point of view also, while doing urban planning one must keep them into mind.

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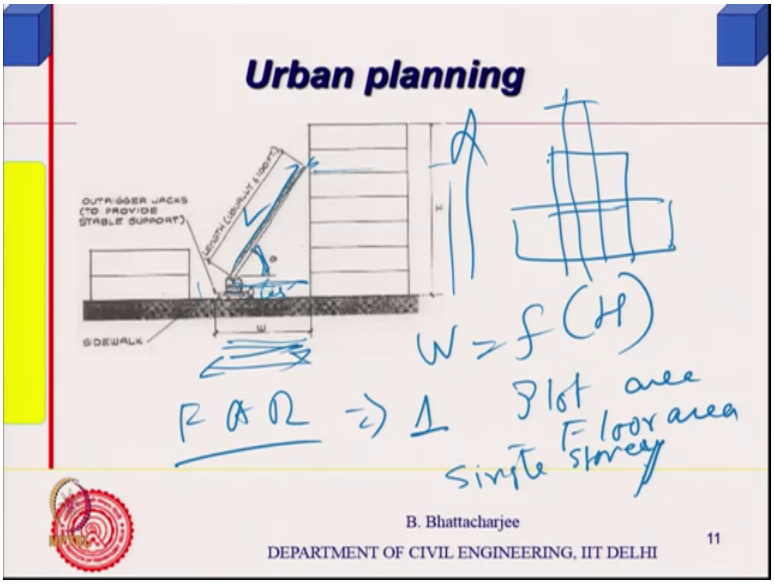

Second issue the next issue is keeping the space around the building, this space it must be sufficient for leather. You know in leather cannot be vertical although there were near vertical today, but I need sufficient space the vehicle will be here. It will actually be there will be supported on a jig it will be you know station there stationary. Then the inclination if it has to be supposing it has to be evacuate people from here. So, taller the building you need so w is a function of you need more space.

And one way of controlling this is through what is called floor area ratio. What is floor area ratio basically total floor area divided by the plot area. So, supposing floor area ratio is equal to 1 then plot area is same as floor area right?

So, you know if it is 2 because you are saying that it cannot be more than 1. Let us say let us say we are saying floor area ratio is one I cannot have it more than that that will be there. So, when it is sink for single story building, single story single story building right, single story building. For 2 story building what will be the floor area each floor area of each floor; it will be half. So, taller the building in a 1 story it will be like this 2 story it will be something like this, it will get reduced 3 story; it will get further reduced.

Because of the floor area is you know this if it is one, but it is actually given the values are given. So, putting a restriction on floor area ratio right? Floor space race index floor area ratio, you can ensure that there is sufficient group. Besides that, you define that minimum width require here is this much; minimum width required a around a building is this much besides you can also restrict the floor area ratio.

So, flow rate ratio gives is one of the ways of controlling I mean; among flow ratio does something more, but it is one of the thing is because it will also control the density. I just given example you know of Delhi of recent years. The tendency is to increase the floor area ratio and they have increase it.

Earlier height of the buildings were restricted in many of these areas nearby IIT say Lajpath Nagar, CR park many of these areas it was restricted. You could not have gone beyond a height. Now the moment it has been actually you know it has been liberalized.

The negative effect of this is population density is increased because where a 1 family used to leave or 2 families used to leave. Now it can 3 4 you know you have increase the storey height storey height are both have been actually increase. The perhaps the idea was to have a construction or real estate boom in areas where the land price is very high because there people will go and purchase.

well it is the negative effect of this is you know the positive effects is of course, it has increased possibly initially, but I do not think the real estate is any more increasing at the moment current state of affairs it is not increasing it is actually; you know the demand for houses. Because the houses, it also gets linked to purchasing power of people.

the people who can purchase they have already got houses are invested in houses. People who cannot purchase they cannot purchase anyway. So, this is a separate, but the

point that I am trying to make is by liberalizing the floor area ratio what has been done is; actually population density has increased right?

By increasing the population density is increased and says urban areas like Delhi or Delhi or Mumbai, the moment you do that the people who occupy there are fluent people. And many of them can own more than 1 or 2 vehicles. And if you are private you know private ah I mean public transport system is not very good, which is definitely was the case very bad. In fact, was the case till metro started right?

People who left their private vehicles and every house now have the density of private vehicles have also increased because the family they can afford maybe 2 cars 3 cars a family. You have given them floor area [laugh] restriction has been liberalized. The population density is increased car density has increased traffic case, as you know all over the country most of the urban areas traffic is all.

You know and then pollution is another thing and construction also adds to the pollution any other by the way that is not part of my fair discussion, but this is very important. So, it is not just like casually people do floor area ratio restriction there are issues and that should be looked into before changing it tinkering with it or coming at a value right.

So, this is important this width is important and it depends upon the height because this theta is fixed according to the machine that you are. So, you need this L cos theta value or H cos theta value height you want to cover H cos theta value. So, therefore, this will depend upon H simply right. So, this space is important.

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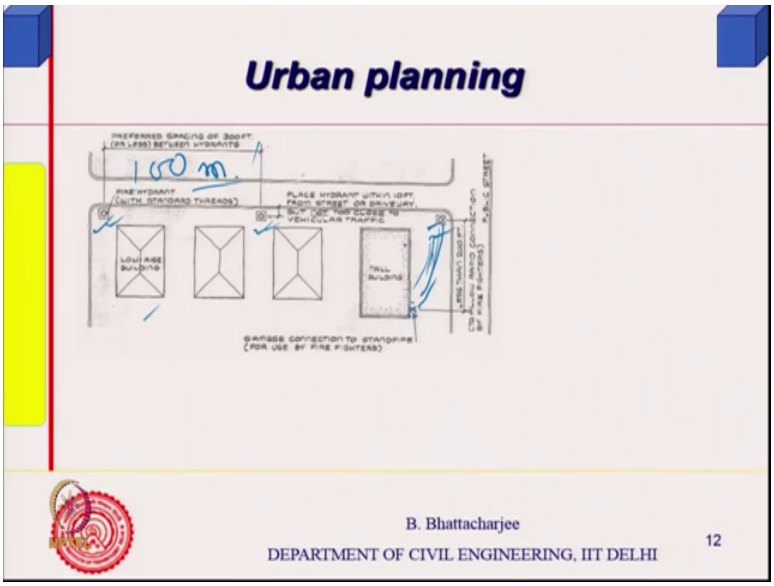

Then the second issue is you; obviously, provide supply of water to the building because the national building code gives you the amount of water that should be there for fire fighting purposes in. All kind of occupancies for each occupancy there is special requirement, minimum capacity of the tank, water tank that should be in house. For example, if you look at the IIT main building, IIT main building that is you did not have a fire fighting you know wet riser or you know fire fighting system.

Manual fire fighting system before it only started somewhere around 1990s, there was a tank size of such tank stored water; that is specified in the code because you need you know to fight them do the fire fighting. But sometime you may not have it in the building itself it might be is provided from somewhere water supply tank outside. Then you have what is called fire hydrants.

Now these fire hydrants are close to the streets. So, goes to the planning itself typically around maybe; you know 100 meters within the specimen space the spacing is given less than. So, if in American standard it would be less than 250 and 60 meters or so on, the distances. So, from here the pipeline can connect this is a Siamese connection through which the pipe goes up.

So, in case of 12 building you know fire hydrant, distance between fire hydrant and where there is connectivity to if you have seen block 3, block 4 etcetera. You will find the fire houses are there. And there are also; you can see that inlet points are there. And

they can be connected to the fire hydrant. And similarly you know so every building should have or some buildings low rise building, you do not need a straight way the fire fighting.

People can connect a hose from the fire hydrant and spray water to this. So, to provide water for fire fighting unit fire hydrants which are plan close to the street. The fire fighting machine they have pumps, sometime you might have even in house pumps through which actually you should be doing. So, this is other thing planning of fire hydrant should not be more than more than. You know spacing should not be more than 100 meters not more than 100 meters.

Distance from fire hydrant to the inlet point in the building should not be less than should be less than 60 meters typically, but the code gives you those values the national building, code gives you these values. So, this is the one thing. Second thing is fire separation next thing is fire separation these are all part of planning.

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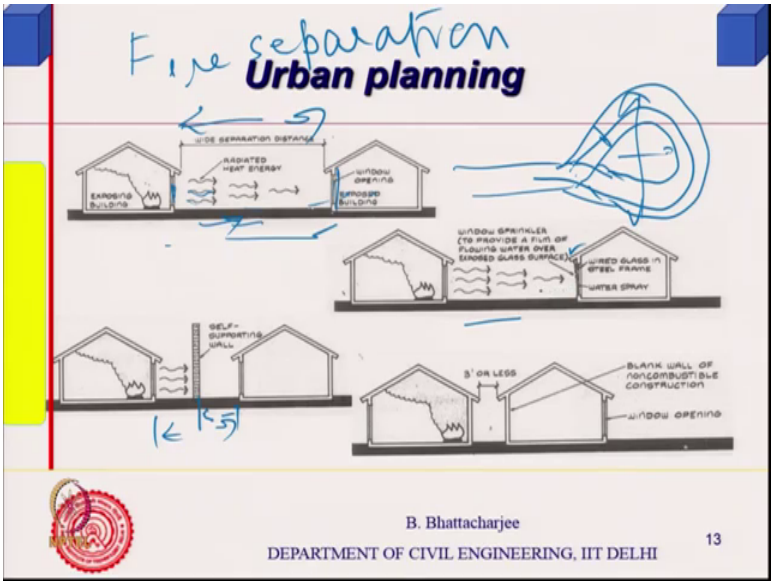

So, what we have looked into so far? We have looked into one is the street planning.

Student: street planning.

Then the spaces around building floor area ratios. You know there relevance to fire planning fire planning.

Student: (Refer Time: 26:55)

Then yeah the space around the building related to the height. Then we have looked into the fire hydrant and the street planning also we said that neighbourhood planning how there should be because we said Cul de sac should be there. A Cul de sac you know it is something like this; where fire fighting vehicle will come take turn and go back straightaway I mean sorry this should be this is like this it can come and you know, like it can come and freely.

So, that this diameter it is all given in the code the values are given in the code. So, accordingly you can you know it should be what should even this diameter state width minimum these are all given. Then we looked into the issues related to fire hydrant, fire hydrant planning of the fire hydrant, which are the source of water connected to a tank larger tank and that can supply water to the water to the building when require.

Now coming to fire separation, fire separation is defined as a distance of the building from potential fire source. The potential fire source could be another building because there might be a fire in that building and it will try to spread to this building. So, all may be an electric pole or anything. So, fire separation is a distance separating 2 you know spaces or buildings we will say; 2 buildings or even electric poles or any other fire source.

So, distance separating the building for any fire source. Now if it is 2 buildings. Then if there is a fire in this one radiated heat will be radiated through the windows, and can reach this one.

So, I need higher separation here otherwise this will spread to this one. So, while doing urban planning this aspect has to be taken into account right? And the walls can be designed depending upon the you know, if the walls are designed in such a manner that the fire cannot enter here, if has got sufficient fire resistance then it has got sufficient fire resistance in that case; the spacing can be reduced, fire separation can be reduced.

So, for example, here I have a wall complete barrier self-supporting barrier which will act like a wall and we will not allow spread of fire. So, the space between these 2 has got fire separation between these 2 building is now less because it is effective fire separation

is this much. Well in this case supposing I have put in some kind of you know specific frame with a sprinkler system here.

So, in case of this gets heated up it will get cooled it is a costly system nobody would possibly doing it means lot of course,, but the concept is separation concept is important. You may not provide a sprinkler, but some cases they might do also not in Indian scenario that is what I am talking of.

So, you can reduce down this distance. These distances should be large when there is nothing. If the fire resistance of this one is high you can reduce down resistance. If there is a sprinkler system you can still reduce down this system. If you have a barrier this distance would be less. And this no window and these are fire, you know fire if there is already fire resistant wall then this could be very less.

So, these are conceptual code gives you the values, but the idea behind the code is.

Student: (Refer Time: 30:34)

This is the idea is right. So, we will break for here.