Fire Protection, Services and Maintenance Management of Building
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Lecture - 38
Planning for building maintenance

So we start go back to building maintenance management, the last slide that we looked into or last to last slide that we looked into.

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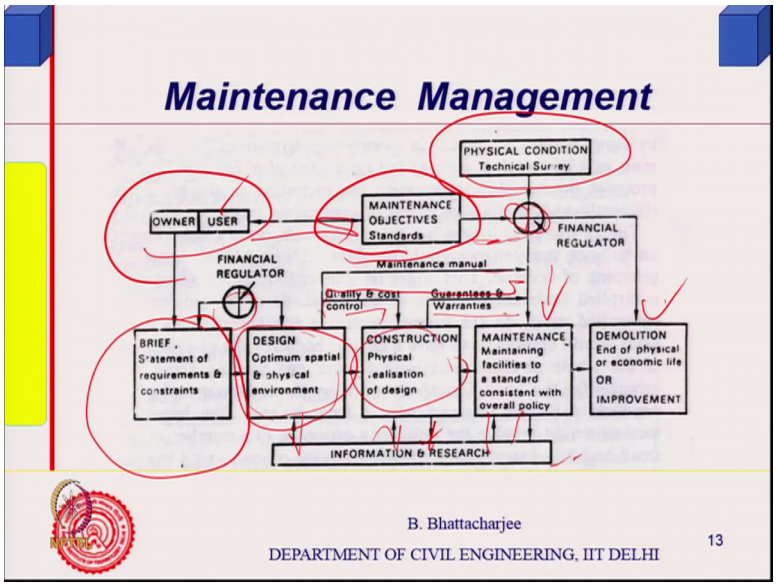

So, I was telling you about the role of maintenance management in overall building process. So, basically as construction starts with you know owner and user building construction starts with owner and user right. Initiating it and then gives a brief that is requirement etcetera etcetera followed by design. And obviously, the constraints will be financial and other constraints.

So, optimal special as well as physical environment taking everything into account both structural design is also a part of it. The design is done and then design realisation of the design is construction, but at this stage itself in the beginning itself for what purpose? The function of the building is decided and it is level is decided right. For example, you know the hotels can be of different kind, hospitals can be of different levels.

So, what type of maintenance requirement that right in the objective is objective is already decided by the owners or users. And then once the design is over the construction is a realisation, and in between comes a cost quality controller etcetera. And there itself during the design stage itself you fix up the maintenance manual, what should be done you know because the design decisions are related to or maintenance is related to design decisions.

Then followed by this is construction which after construction has built situation, also you are given guarantees and warranties and all that. Then here once the objective is known guarantees warranties are known. Maintenance manual is available to me every 5 yearly, you know I survey the physical condition may be every yearly I do some inspection.

And then financial situation I see whether I can maintain this building or not. If I cannot maintain this building then; obviously, I go for demolition end of physical life function life. Or something as we said or else I continues the maintenance you know as it is supposed to be facility as needed right. According to the currently acceptable standard, and my information flow also takes place feedbacks are always given etcetera etcetera. So, this is: what is the role of maintenance in overall maintenance management.

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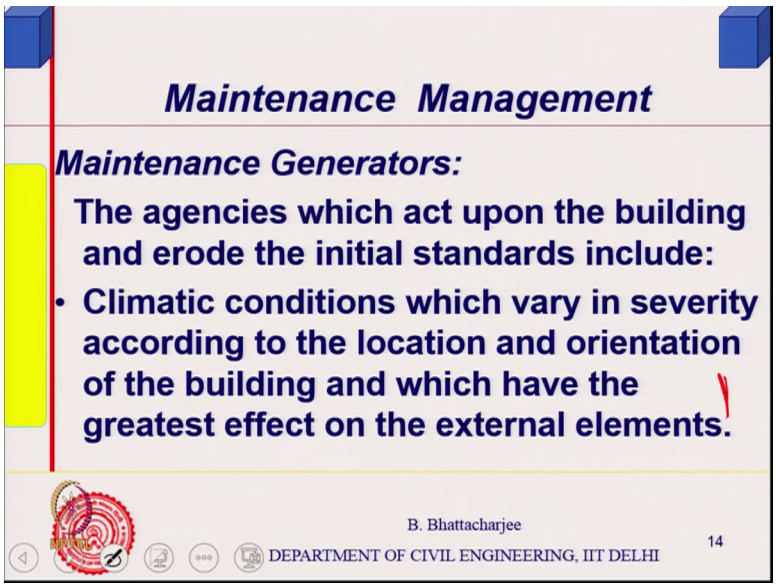

Then I was looking at what generates maintenance I think that is what we are looking at, we said the agencies are once the climatic condition. And they have their major effect on

external factors for example, rain, wind etcetera etcetera. Particularly wind revolve rain and they would result in deterioration of certain element or affect many things for example, in moist environments even, you know in any in steel metal will start corroding and so on.

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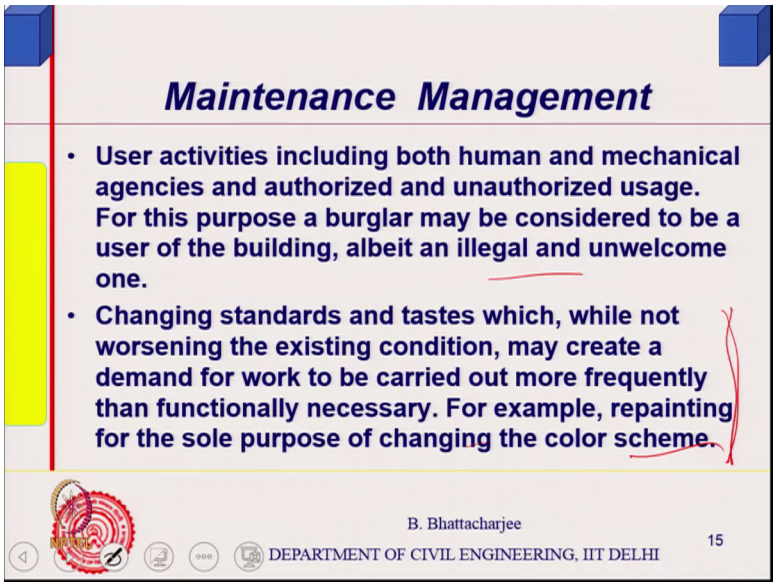

So, therefore, environment has got an affect also users activity, like I mentioned in the last class that users activity includes some example, users activity for I was giving an example of an industrial situation where there will be loss of abrasion in the floor because some heavy machineries might be moving, some cranes might be moving similar things and that will result in deterioration of the floor and therefore, you to do it maintenance periodically.

Also some time because of simply change of standard. Change of standard means; you know currently acceptable finishes. This is much most realising the finishers of course, some cases the other situations also standard changes. Like I said the risk perception related to earthquake which has changed. So, such would be in that you retrofitted to the current requirement or energy perception has changed, you need better energy efficiency in that case. You might retrofit it to currently acceptable energy code alright. So, and this might change with time to time technology would change some cases technology will change for sample lamp technologies are changed significantly over last 10 15 years.

So, while we used to have been in candescent lamp or fluorescent lamps. Now we have got CFL and then LEDs. So, there is a change and therefore, they are you know the system might be technologically, but maybe new earlier we did not have network requirement. New services would come depending upon you know requirement of network Wi-Fi facilities and so on. So, all these are also generates a kind of maintenance not necessarily you know, it does not have any the worse current situation has not worsen, but there is a change of taste or change of requirement. So, therefore, thus you know this change in standard also generates building maintenance.

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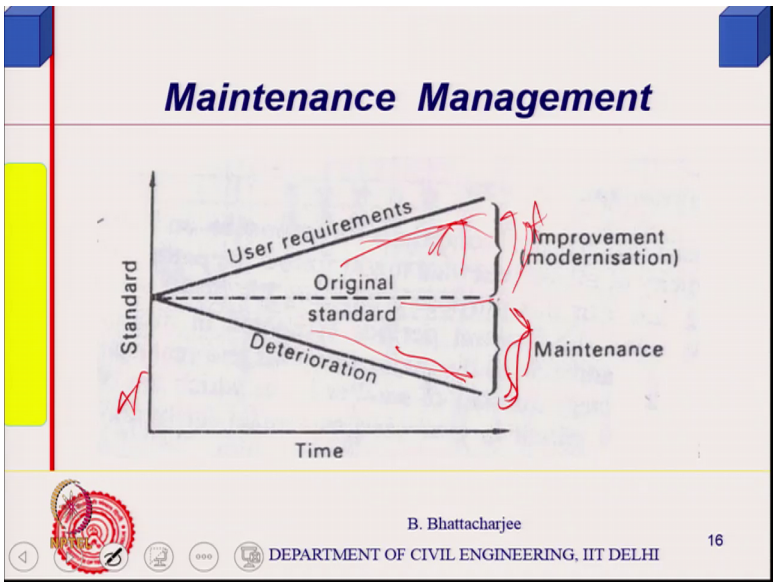

So, you would see that generally users requirement will tend to increase, users requirement will tend to increase. So, if I see building as a whole as single building as a whole, for is not single for a given item it may not for a given item in general is being talked about, standard or such requirements go an improve increasing. And anywhere the deterioration that occurs that goes on winning you know current state. You have as a current standard current state into deterioration cause it to cause it to go down.

So, this is maintenance this might be some sort of improvement right, but basically that goes down that goes up and original condition is somewhere here. So, in buildings maintenance scenario unlikely let us say mechanical system automobile; automobile you know generally changes in the system unless you are retrofitting into, let us say petrol engine to a CNG engine or something what dissolve in CNG engine usually.

Most of the time it is not the case, you just replace the same part by the same part. And if you do not get if it is obsolete then it is obsolete the you know that automobile itself might become obsolete. Similar situation with many of the many of the even other consumers items right. So, obsoletion is that there the obsolutions is there.

So, they would say that you know the manufacturer has stop producing that product like Maruti 800. Now supposing you have to have a Maruti 800 some parts is bad and you want to change it. In that case you may not get it from the original manufacturer they might stop it after, you know once they stop the production of the car they might have stop the production of spare parts as well. So, they are the situation that do not arrive. But here what happens in buildings, building is very much there obsolutions is there, but relatively less, but more importantly what will happen is there is a change in taste and standard, or even requirement. So, frame skeleton structure building is function may not changing, but you might change simply the other finishing items or similar sort of thing there could be changes.

So, both improvement continuously goes on here and that is why there is an increase. And then you have to bring it back some of the items which have deteriorated here always bring it back to the original standard. So, this will require maintenance there is some always improvement you know a part in maintenance. When you do maintenance planning one has you look into both, at least some sort of you know one should have some sort of idea, where this is likely to you know you have to budgeting and you have to keep that in mind, so general consideration one can have.

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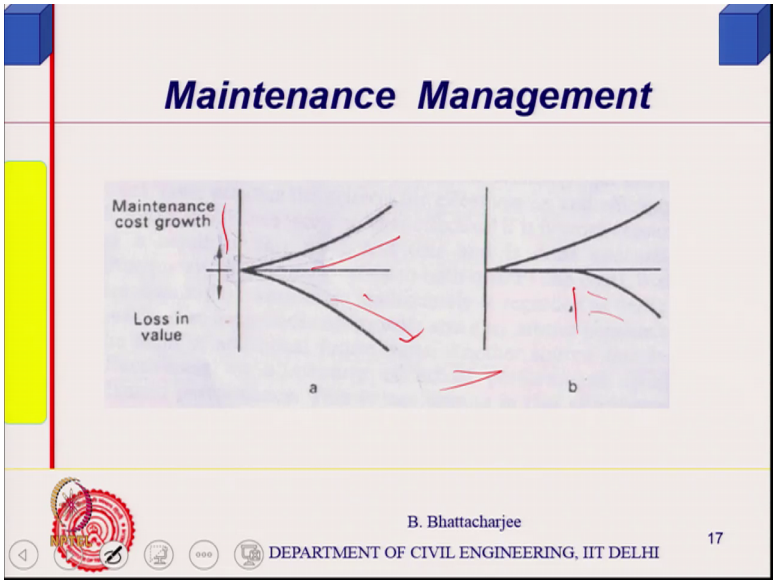

So, what you see the cost wise? Maintenance cost grows with time in this manner right. And if you do not detour you do not take care of the deterioration value loss will happen in this one. If you take care of the you know value loss do not start all the time from the light in the beginning. Some cases value start loss you start realising later on. For example, you know deterioration in some cases may not take place instantaneously it might take some years it is fine then it surfaces. Actual deterioration might be taking the value loss might shop later on alright.

So, you know so value loss in some cases for example, some internal deterioration is occurring it may not surface immediately. It might take some what longer time. So, this you know the some cases this it be the model some other cases this will be the model so both can happen. Value loss can it can show up later on. So, that is what it is; now how much this agencies or they would affect your maintenance program. That depend upon extend to which actually this maintenance generators effect depends upon; obviously, severity of the climate.

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And you know depends upon severity of the climate, and how much you have actually force in it. So, and if you have force in it then when the design and the sustainability of the material will be specified remain the design itself; you can do in such a manner that it can take care of some of it, you will you know it is a the maintenance requirement will be less.

For example, use say you know pipes G I pipes. Now G I pipes they have the life or let us say I give an another example electrical wiring. Now you might decide to aluminium wiring or you might decide to use copper wiring. The life of copper wiring possibly will be more; 25 to 30 years whereas, aluminium wiring you might have to replace after 15 years. So, you would if you have envisage the scenario seen the scenario for seeing the scenario, and how much you have designed for. So, the extent of damages that you would see would be depending upon. The design right in the design stage itself what you have forcing.

Then; obviously, the workmanship standard of workmanship is important. If the workmanship has been good, if they have constructed it well; you may not have much problem of maintenance. I just give an example normally you will see that you know it is quite often what happens is, quite often what happens if you have let us say this is your you know section of a flooring.

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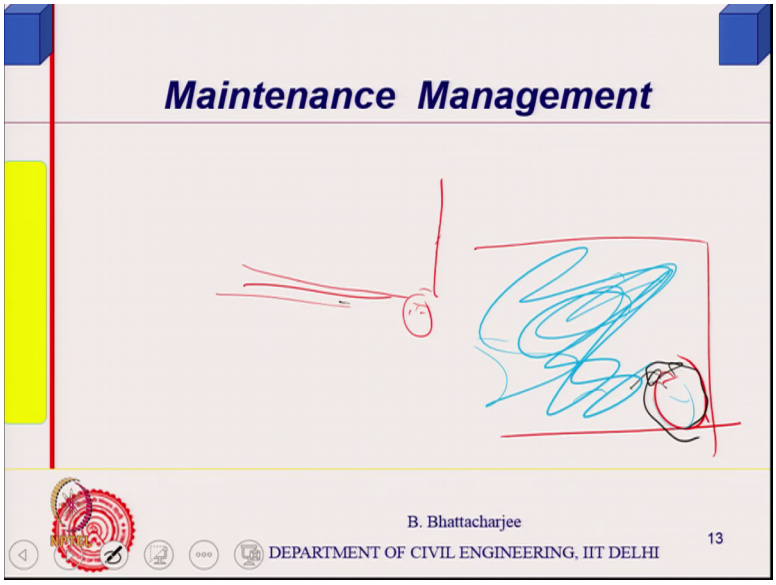

And you have a trap here gully trap right flooring of a bathroom shower room you know. So, you have a gully trap here in some one of the corners somewhere in the elevations just like this. Should I good slope? But quite often if it is not being done properly you might see that; the trap is here I mean in plan if it looks like this something like this, here is a trap planned let us say. And you will that quiet often what they do is they put in kind of a for jointing purpose they put in some sort of a cement model joining.

You know and if it is not done levelling properly done actually there will be all the slope is not proper, you will find water accumulation in all over the place, water accumulation all over the place right. For longer period of time when it should have drained of straight away, you will find that it you know it is long or sometimes it simply holds or some other very peculiar sort of construction details problem comes. So, if the water is, sorry excuse me. If the water is stagnant here standing there for long time it would have a tendency to cause seepages in the long run.

You know the flooring that would be exposed to water for longer period of time absorption capillary absorption etcetera etcetera. So, this is one situation, but supposing the slopes were proper, this is also proper that it just simply drains off instantaneously as ay it should be then. So, that workmanship plays a big role therefore, construction workmanship. Another example what sometime you might find, you know cases of I mean this is this you find a normal in buildings this happens. Buildings where the construction some of these are you know relatively manual works, manual skilful work actually the this and if it is not done skilfully then there is a problem.

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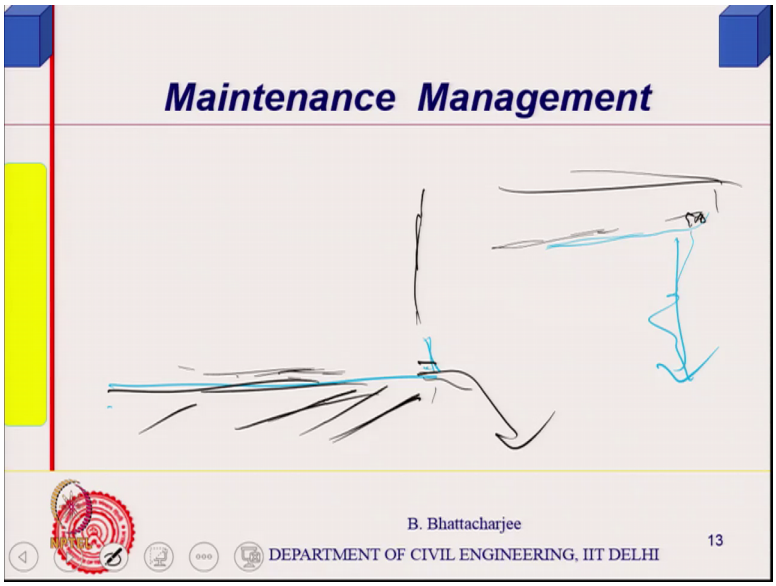

Another example I will give you might have seen balconies. And then you have you have railing there right, you have a railing there of course, standing railing should be there, standing railing should be there. This is a balcony floor right this is a balcony floor. So, railing there etcetera etcetera railing standing there. Now, you normally should have a what is called as spout hole here. So, that the any water rain water coming then this will mildly sloping in this should rain water should drain out. Now supposing spout hole pipe that is fit in is one inch above the bottom level. Then after the rain you will have a always stagnant water up to that average. Actually it should be exactly matching with the flashing with the floor and raining.

So, such details which quiet often overlooked, there may be also a situation in a sunset. When in a sunset you might have a drip course you are supposed to have a small drip course here. And, the if it is missed the water would always be so these are detailing construction quality. So, water will have a tendency to flow inside, but if there is a the drip course then there is a come down straight away it will have come down. So, these are some of these workmanship issue which you lead to actually extend to which you will require, maintenance extend to which we will require right. So, standard of workmanship and standard of design as well.

So, design a like I give an example of by a choice I have taken copper instead of copper I will be using aluminium, or similar sort of thing many a places by choice you do and that

is all. So, this is this is what actually the extent to which I need maintenance will depend upon that. And therefore, actually I can do planning right in the beginning as much as possible ok. To do that what we do is we classify materials or systems in to different classes.

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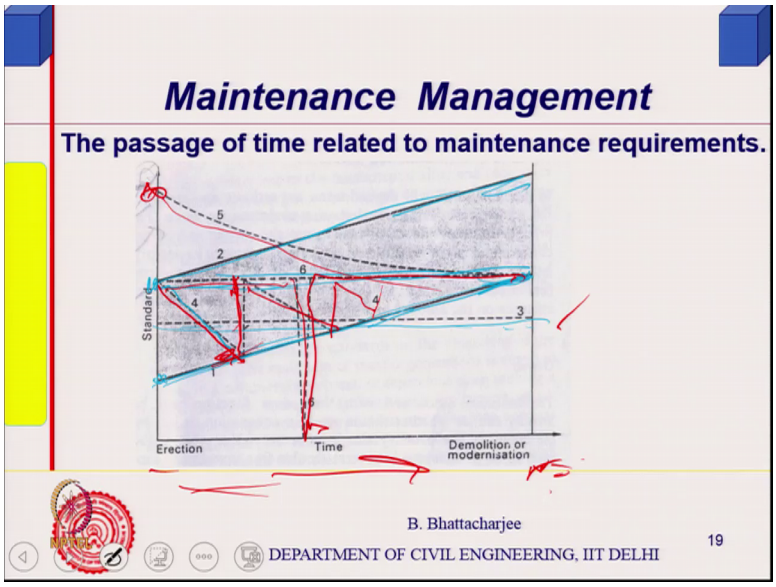

So, at least first thing what we can do is; we can classify them into simple 5 6 types of elements right first 5-6 types of elements. So, first one now, typically the standard will have a tendency to go up right. And some items will be related to standard changes not everything will be related to standard changes right. So, this one actually gives you the bottom most line to start with I have actually, I have started with here started here essentially the standard in the beginning is here. Standard in the beginning is you know somewhere I have put in here standard in the beginning acceptable standard somewhere in the beginning is something like this.

Now standard over will go on something like this, it will go on improving some cases not all elements, some elements were chance of standard going up. Some elements that so therefore, one can think in terms of a boundary that this is my level and this is my lower level, this is my upper level this is my lower level. And actually things might be vary between the 2 whereas, standard changes occur actually standard changes occur. But this is the minimum acceptable level not shown as these are not shown for each type of element quantification will be different, units in which we express will also different.

Some other items could be there which do not change with time. For example, foundations there is no question of changing and it is standard is also are likely to change, structural system there are likely to change.

There is of course, structural deterioration you do see foundations also might have a problem if the design has not been proper. For example, if you know soil characteristics has not been estimated properly. Foundation design has not been proper the consolidation aspect, you know of the soil long term soil consolidation that also mainly look in to properly. You might find there is tilting or something of a building as a whole. So, these are these are not really the serious not really maintenance problem and you do not expect them to happen. You expect that design should be adequate right design should be adequate. So, normally we assume the structure system and foundation system they do not really; show up much of a problem and I can leave the standard as them themselves.

Having said so I right to qualify some cases in the beginning if I am planning I may think that that nothing will happen, but still over the time you might find somewhere that this is occurring right, this is occurring. So, you take care of that in kind of a what you call contingency budget if that is there, but to plan with I do not think foundation will have a problem. So, my foundation and structural system frame etcetera should not require maintenance right?

Steel structure would need because I may have to do, painting. You know structural steel member if they have not encouraged, but usually in building there are in case from fire point of view ok. Now certain item should be there which shows a kind of deterioration like this which shows a kind of deterioration like this, you know shows a kind of deteriorations deterioration like this.

And the moment it reaches and normally acceptable standard you repair it bring it to it is original state. So, we talked of certain items were standard change will be there possibility I can think in terms of a range in which they will operate. Some items the item number 3 no changes at all foundations and structures. Third I am saying another kind of one which will show there is a slow deterioration process, the moment it reaches some level I repair it and bring it back to it is original state. Then again it will deteriorate and this kind of cycles of repair I would need. So, we have now classified at least 3 to 4 types of items 3 types of item. Structural framing etcetera do not need anything they are

not supposed in the planning stage itself. Then there are certain items where deterioration will occur for example external finishes; in a depending upon the environmental where you are you need external painting to be redone after certain period of time.

If it is painting or even exports exposed concrete structure you have to do washing to remove the algae and such thing. So, deterioration value of period of time slowly, then you bring it back to it is original state. And if there where standard issue there also, but is normal is standard issue should not be there. There are certain items which fails suddenly for example, water supply line it fails suddenly complete failure. So, it goes right up to the bottom and you have to restore it back to it is original state as quickly as possible right. So, which time this is a life cycle you know life of building so erection to the demolition time. We have classified we see that we can classified item into 3 4 classes so far.

One is where standard changes should be there so there is a bend in which we can operate. The second one which would need do not need any kind of changes. The third variety where slow deterioration takes place are bring it back to it is original state. And the 4th variety sudden changes, a fifth variety so slow deterioration that what I do is I keep it at higher level right in the beginning.

So, slowly it will deteriorate and reached a level after the end of the life to an you know minimum acceptable state. Since the buildings as I said were very complicated and they have you know large number of items of varieties of traits involved. You will have civil, mechanical you know in mechanical plumbing services, electrical and today possibly when computers you know IT involvement telecom and IT involvement would be there. So, so many traits are there all together right? And therefore, varieties of items it is better to classify them all will not show similar kind of maintenance requirement alright.

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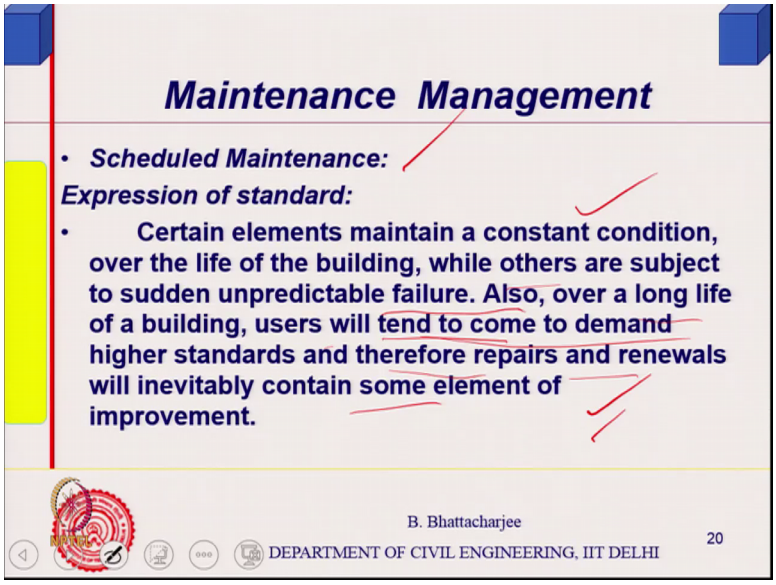

So, to take care of this we define you know we actually just to take care of this what you do; and why you were doing this first of all I would like to if I classify all the items in different classes right. Then I can each item type of item wise I can see their maintenance need or periodicity of their maintenance periodicity of their maintenance right, periodicity of their maintenance which we look into.

So, periodicity of their maintenance while something will require like as given in wiring you know rewiring to be done; that would be 25 hours years or something of that can you use copper wiring. Because, you do not know that it would give up after certain period of time, what will actually happen is the you know there will be too many possibly emergency calls because of short circuiting or something like that.

You know lose I mean the wire should have given up what about insulation will give up the possibility it may not be worthwhile to continue with the wiring beyond 25 years or something like this. So, you I know this I can this is one kind of item while external painting is another kind of item where standard or internal painting particularly were standard might play a role. So, I did not structural items there is a third variety of items. Plumbing services water pipelines, it is are the pipelines water pipelines or waste water or drainage system they are another variety.

So, large number of them as them I can actually classify them to several classes, and when I am going to do that periodicity of their maintenance requirement I can find out. While if it is plumbing services I do know that impossibly depending upon the situation

cost around pipes if they are they are the main pipeline coming to the building, let us say as we have discussed earlier.

Maybe to last for 30 35 years because of the you know because of the rusting scenario or internal deposition if you are using groundwater sometime, you know if it is not decanted properly, if the suspended metals are not really separated out properly. It might caught cause deposition on to the pipeline themselves pipelines this is what the case in IT actually there. So, they are start replacing after 30 40 years or so.

So, but in between you may have to do sudden repair therefore, such items you cannot plan it. Suddenly repairs or cannot repairs where you know the pattern of deterioration where you know the slope at, you can actually plan right; in the contractions phase you can plan that every 5 yearly I will have to do this maintenance. And you can budget for it on the budget or planning as itself maintenance manual. You can generate. So, you can generate it right.

So, that is what it is, but to do that what I could to do. So, scheduled maintenance relates to this, as much as I should be planning I will talk about this later; now, in order to do that I need to quantify everything, right. How do I say, on what basis do I say that I go to change the external painting or external you know facade look of the façade, after every 5 years or after 12 10 years or something like that.

So, I must have a way to quantify this to quantification may be in different ways not necessarily. I might say there could be separates some cases I it would be possible to express it in physical terms measurable physical terms right? External painting of course, is not really necessarily measure may not look may not be measurable material stub, but some other items I can simply measure.

Suppose in some losses of dimensions are there some places I can you know measurable items to be there some places. I would able to measure for example; you know the reflectance of the surfaces. You know this is this is got a relevance in lighting both artificial as well as day lighting. Because light from even the lamps they will be reflected from the walls and reached to the room. So, general level of lighting in the room reflection has get role. So, if it is of course, it is functional building like classroom or similar sort of situation. If it is the living room it is a decoration part of it you one might like to you know, interior decorator might decorate the way the light. That is the different

one that is you not the, but where is in functional requirement of lighting is there you might like to know the reflectance as should not go below 0.7 or 0.8 or whatever it is if there we trans something called maintenance factor we take a maintenance factor right.

So, one can measure this in fact, measure how, use a lux metre a lux metre measures light. So, lux metre you first face it to at it, if you face it to at it will show how much light is you know face keep the lapses on a top of the surface. So, whatever light is coming in you know reverse it is direction at significant distance sufficient distance I mean one can do that experiment, and find out how much is reflected back. The ratio of the lighter to the formal will give you the reflectance of the surfaces reflectance of the surfaces right it will give you the reflectance of the surfaces.

So, this is measurable items so you will say that the reflectance goes below 0.7 I go to do the internal painting or even below 7 you might seen 0.75 or something because you will be planning. So, they are all quantifiable items in functional aspects also. Several things you can actually quantify. So, some cases is measurable, standard can be measured. So, you know. So, also over a long life of building users will tend to come and thus we said already standards are set.

So, some certain elements maintain a constant condition that we have already said over the life of the building while other subjects these have discussed already subject to unpredictable failure. Also very long life of building users will tend to come and demand higher standards and therefore, repairs and renewals inevitably some contain improvement, which I have shown you and I just mentioned.

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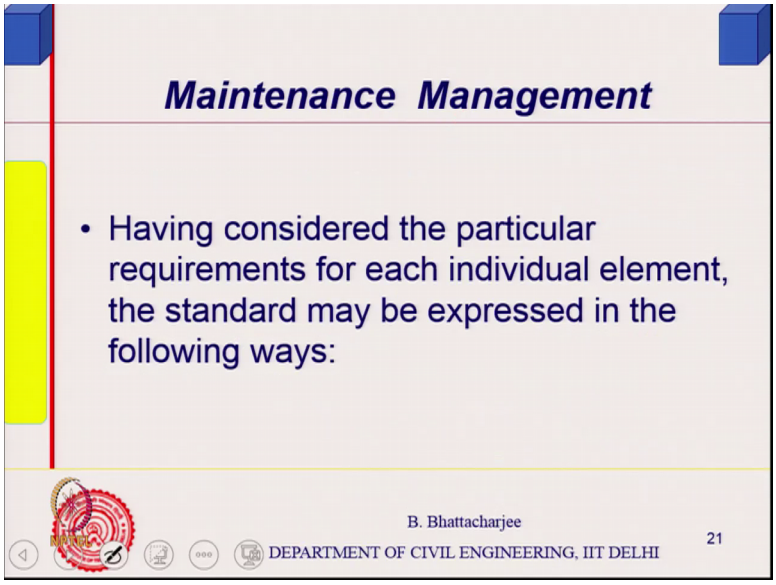

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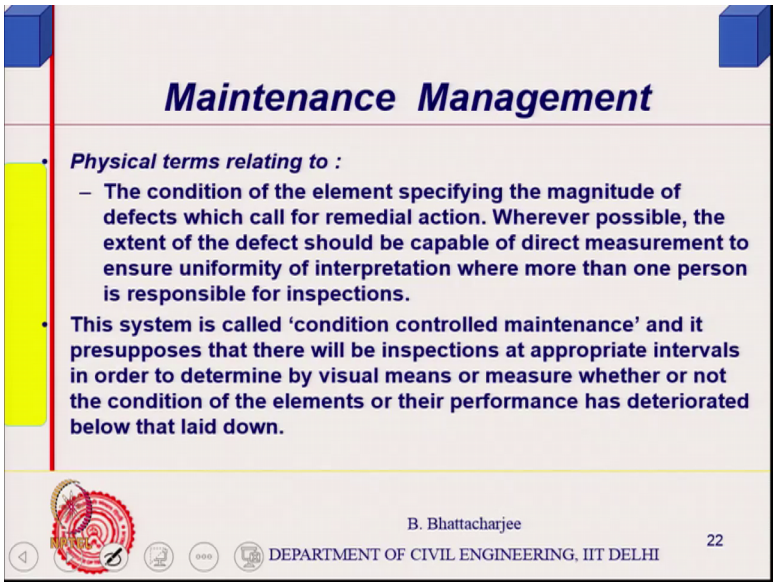

So, standard may be expressed in following ways physical terms that is what I say.