Project Planning & Control

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Lecture – 41

Lesson - 02

PDM Network Representation and Its Issues, Network Calculation

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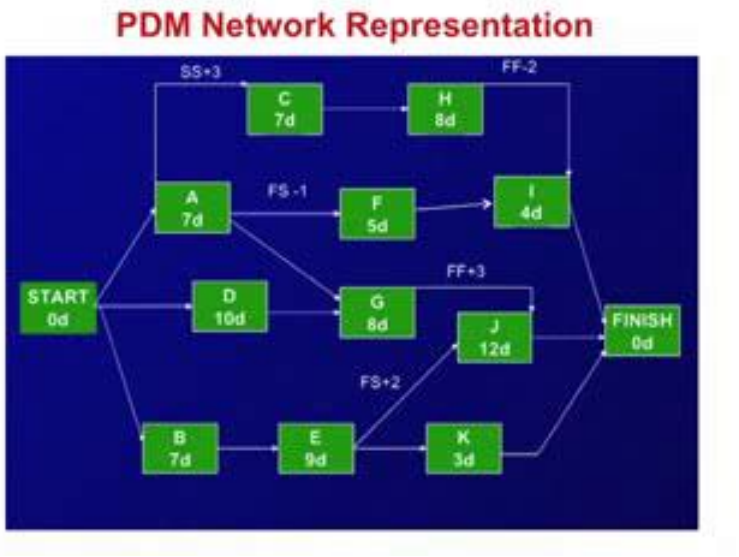

Now, so when you put together a PDM network it look something like this and it is, so you can see, you have the same kind of nodes as an activity on node. You have arrows representing relationships. You have, where you have not, where you have finish-start relationship, you still show it without any qualification, let assume finish start; that is a default, where you have other relationships you show it. So you can see, this is a start-start and where there's lead or lag of course, you can show it here.

And here again, you have finish-start, okay, with a lead, finish-start with a lead; finish-finish with a lag. So this is G and J; it is a finish. Okay, so this is what the network representation for PDM looks like.

Student: sir, plus represents lag?

Plus represents lag, there is a delay. So, A will start after 3 days of delay, of 3 days later C can start. C cannot start 3 days before, I mean, before that.

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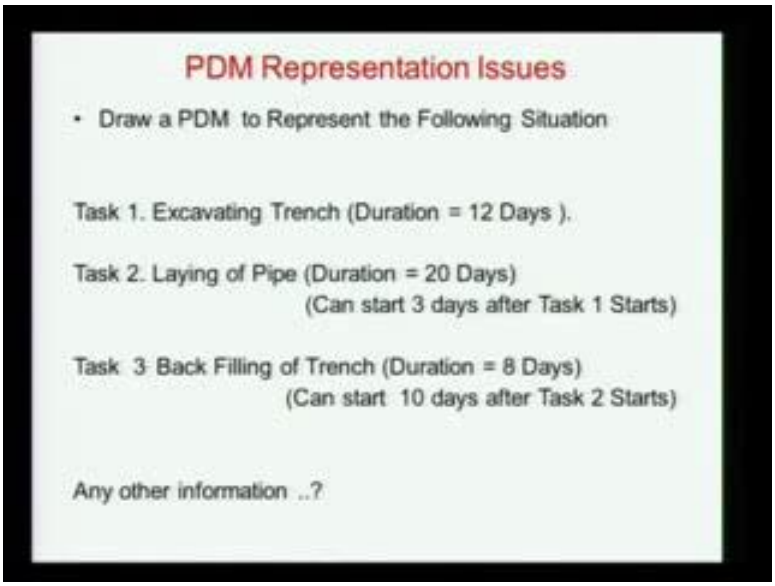

Now, let us look at this, really this relationships cause some kind of issues. And this is very common to misrepresent the real world. So, when we looked at activity on node itself, we found that finish-to-start relationship: visualizing it, representing it correctly, had, we had a think through and get used to it. So in PDM, it is more complex. So, let us take a look at this problem. Now we have represented it earlier using an activity on node and we have to split the activities. But, let us take this and see how can we represent this using PDM. So, can you work on it for a couple of minutes and then we can discuss it. So, how many activities?

Student: 3

3 activities

Student: ((Refer Time: 02:22)). All are start-to-start.

So, it is, if you are still working on it or?

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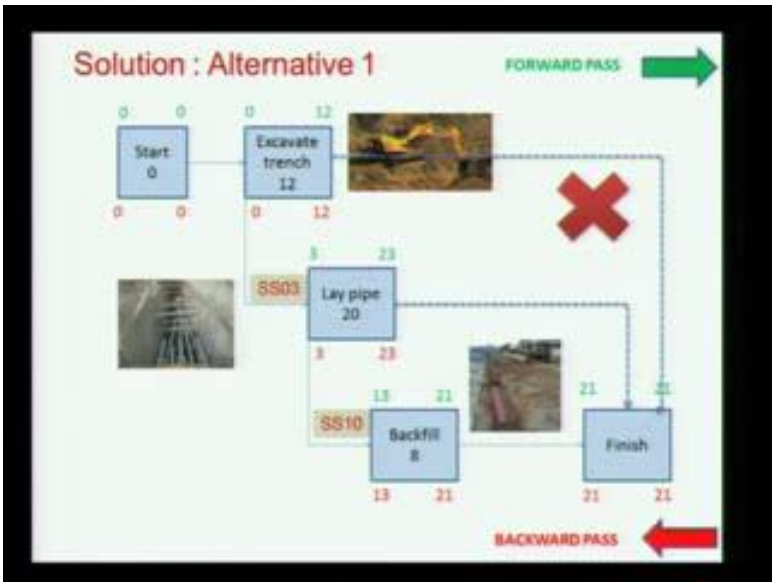

Okay, so, let us look at an alternative one, we will say excavate, we will have a start-to-start lay pipe and backfill. Now, this is a very common, I would say representation people do, because they look at the start parts of it and we need to finish. Now, as you, we have learnt network analysis, this is a simple enough network let us try to analyze it. Can you, have you got this diagram or have you got something different? Now, do an analysis. So, as we start doing the analysis, we will see the early start, so laying, so you can see as we go we have 3, 23 and then we will go to backfill, it goes to 21. There's the problem.

So; obviously, we know physically that we have to back fill only after laying.

Student: So, finish to finish relationships

So, we have, we know now our finish-to-finish has to come somewhere.

Student: In the first SS03, we say that we are going to excavate the trench and after 3 day delay, we are going to lay the pipe and…

We're going to start laying the pipe.

Student: We can start laying the pipe and as we are laying the pipe, after that 10 days, the back filling will start.

Yeah.

Student: So, that, there will be 13 or it be should start from 23

Where is?

Student: No, no.

It is start-start relationship, if it was the finish-start, then it would be...

Student: Sir, but ideally we will be laying the pipes until 23 days, but backfilling will be completed by 21, so it is not possible.

It is not possible exactly; that is the point we are trying to illustrate.

Student: So, another relationship..?

Right, so far this is a typical problem which comes up on when you try to implement a PDM. People represent only a single relationship between activities and this happens and then say oh yes, I need the finish-finish relationship. Okay. So, it is very common, so let me just finish this, so; obviously, this cannot happen and when you go into, I am just doing the backward pass and you want to, first of all you want to connect these two.

Before, you even do the finish-finish you cannot have a dangling activity. You try to, people try to connect these, but it just does not work. You will have, the network representation does not represent the project. You will have all kinds of values floating around and it will be not meaningful. So, they say yes, we have not done a finish-finish relationship.

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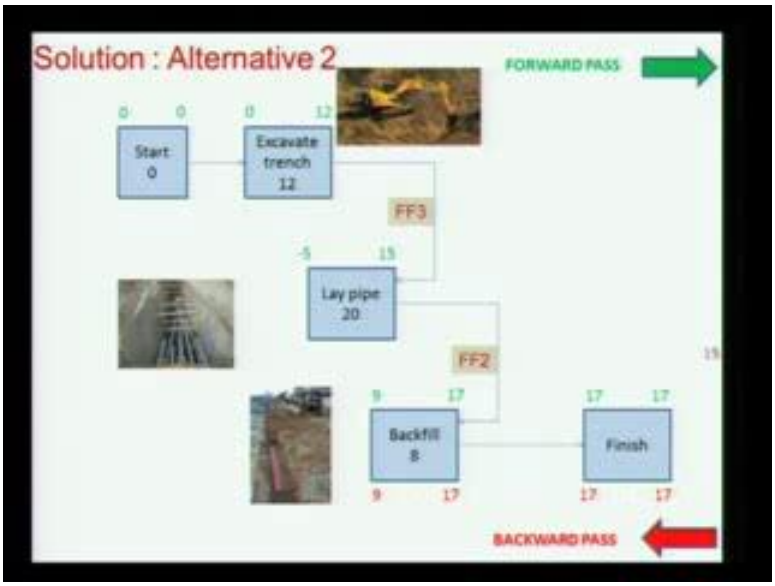

So, you get into alternative 2, you will excavate trench. You will say, look laying pipe can be completed only after 3 days after excavation. You will say that, backfilling can be finished only after 2 days of laying pipe and then, you will go with 'Finish'. Will this

solve the problem?

Student: No.

Why? Can you quickly just draw this representation and see what problem it will create. You have not covered your analysis of finish-finish and start-start, but I assume you can apply the logic fairly simply in this.

Student: So, but we do not know when the laying of pipe starts.

Right, but I am saying that laying of pipes can start, that is true. You do not know when laying of pipes start. So, I am saying it, you right now you say let it start, so there is a lot of times I've heard people say let it start whenever, so that it finishes on time. I am only controlling the finish, I do not want to control the start. So, when you work backwards from here, so let us do the calculations so as you go in, you have 12, now how do I calculate early start, early finish of laying pipe.

Student: We have to do it, 10 to 15. The duration is 20.

Right, so this is the problem we are running. So when you have to do this calculation you have to go in the direction of the relationship. Now, we run into all the same, so these, so when I come back here. So, now you can say I have to lay pipe only when I, on the 0th day along with the, then the whole thing gets mixed up. What is the solution?

Student: We need both.

Right, so the solution is, so this also is not perfect.

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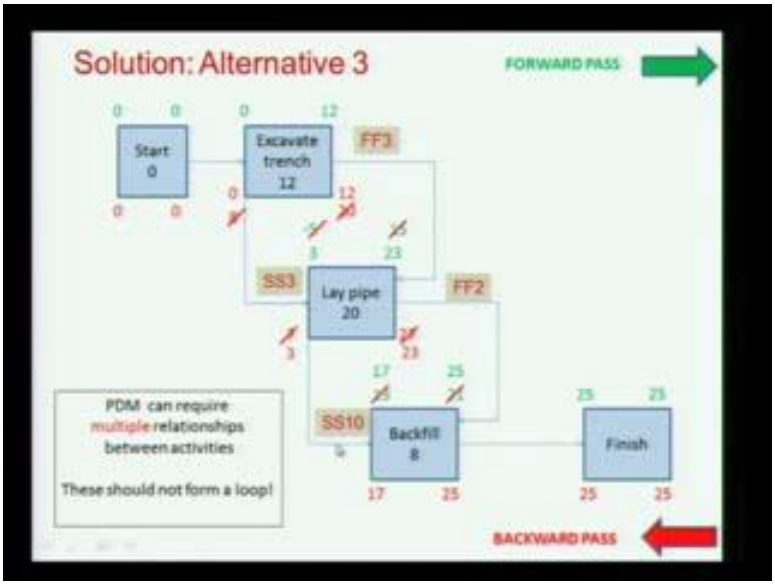

So, you need this, so what we are saying here is, the excavate trench, my laying pipe will start 3 days after excavation and by, I have also constraining laying pipe with the finish-finish relationship and is this reality now? This is more like the real project. Okay and now there are software, which will not allow you so the difference between an AoN and this is now you have multiple relationships between activities and in the earlier case we only had as, so now you have the, so while you are saving on activities your relationships are multiplying.

And generally when you are in a planning engineers position or in a construction, activities are easier to visualize than relationships. So, as your relationship starts multiplying and getting more complex, if unless you are really good control and understand why you have putting this relationships, things can get little bit dicey if you do not know what relationships you've represented where. And it does not stop here it, gets even more interesting.

So, if we solved this what we can do a quick, so can you can you solve it along with this, so,

Student: ((Refer Time: 09:02)).

Yeah, we will not worry about float, but let us look at this, so we go through the.., so we had the early start the early finish. So, here we now have 3, because this is supposed to start 3 days I mean it cannot start within 3 days. So, we are putting it as 3 as the early start, 23, now coming from this side we get 15 minus 5.

Student: 20 will ((Refer Time: 09:41)).

Yes, so we will take 23 the max one, okay, now we come here 13, 21, 25, 17. So now, this is controlled by the finish relationship. Okay? So, we do 25, 25, now we come to the backward, okay.. we have 25 here 17, 17 we go back, 17 with the start-start we going back on this 10, I am sorry back by 10, 7 we go to 27 here. Okay.. but, when we come through this relationship, it is 25 minus 2, 23, 3, so this is what? Okay? Now, we come back here 3 this is 0, 12, 20 when we go back through this look that is 20 minus 3 is 28 this gives you the results.

Now, so, you can see PDM can require multiple relationship between activities and this relationships when to represent, how to represent, how to constrain it, can be challenging and while we can have multiple relationships, this relationship should not form a loop. Sometimes for example, I mean in this case it very straight forward we will not form a

loop, but if you do lay pipe, , instead of finish-finish between this and this, and it is the other way round, you are software cannot take it or any, you cannot do any calculation on it because it is iterated.

Student: Sir, in back filling why cannot we start on 13th and end it on 25th, because it has to do for 8 days. But, they can..

Right, so right now I am assuming constant duration, I am sorry continuous activity. Your bill, the point you raised is correct and we will take that up in the next phase or towards the end of the lecture I will discuss, how further complexities of the precedence diagram. So, just to give you little more insight on the question you asked, yes, you have basically entered the others, you are is suggesting start this on 13 and extended all the way to 25^{th} , fine.

So, nothing prevents me from starting on 13 meaning I am unconstrained. Only thing is then my duration hasn't changed. So, right now I am starting with, I am staying with constrained duration, meaning I constraining my duration to be continuous. The activity will be continuous. Okay, so, if we actually look at the calculations we have done, we have done it more out of the common sense of looking through the network and going, but basically we follow very similar rules to the activity on node, except that you are relationships are more complex. So we've, we did forward pass and I have shown you all the four relationships that are possible.

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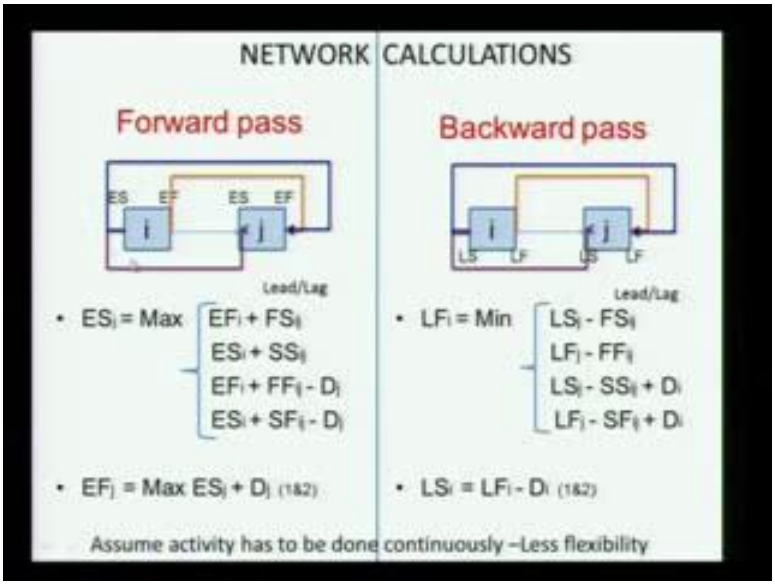

So, what we've taken here, so if this is the preceding activity and the succeeding activity.

The early start of the successor is the maximum of early finish of the predecessor plus the lead or lag. Or, see this is the early, this is the leader lag of a finish-start relationship. Early start of the successor plus the lead or lag of a start-start relationship. Okay, early finish plus the leader lag minus the duration, this is, where we are saying duration is, it is a continuous duration.

And similarly, we would calculate, so when you go in to a, you will calculate the early finished as the maximum of this plus the duration for 1 and 2. For the other one, it gets computed. Similar rule applies to the late finish. For the backward pass and the late durations and like we have written on here assume activity has to be done continuously and when you assume the activity has to be done continuously, the flexibility of a, what you want out of a PDM is reduced. As you discussed if I can have the flexibility of starting on 13 and when we go back here, starting on 13 and finishing on 25 is okay. It is okay. I should have that flexibility.

But, they analysis then becomes complicated. But that was the original intent of the PDM; that my start and my end is not constrained. So, this is PDM with the duration assumption.