Project Planning & Control

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Lecture – 26

Lesson – 08

Two – Span Bridge: Resource Constraints in Network Logic

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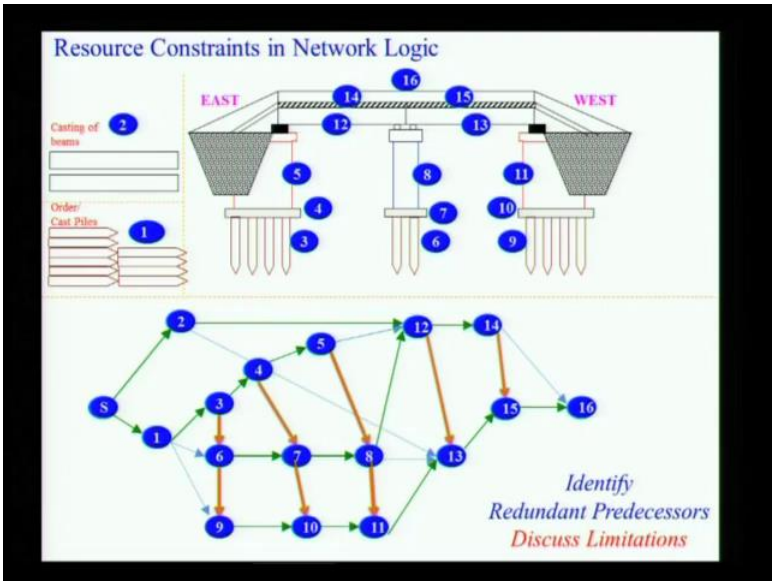

So, now we will move on to looking at resource constraints in the network logic. So, I have actually shown a bit of the constraints which I want to use. And I want to discuss this a little bit before I actually start. So, we have the same network; now all I have done in this is to say that activity six can start only after the resources from three have been released, because 3, 6 and 9 are piling, I am saying I need a piling rig, I can only start six after three is complete, I can start 9 after six is complete. Similarly, I am assuming all of this like 4, 7, 10 need the same crew, 5 crew and equipment 5, 8 and 11 need the same. So, I am just assuming symmetry and I am putting this two. Now do you see any anything in this network which you would change?

Students: these become redundant predecessors

Right, the blue arrows become redundant. So, what do you mean by redundant. So, for example, we are saying here that we know that piles have to be cast for six to done. We know that

Students: We can only start once three is done…

Once 3 is done. So, actually I am having the influence of one through both through three and one directly. Is there anything analytically wrong with this? If I do a forward pass based on this, is there anything analytically wrong with having redundancy. I like to take the maximum.

Student: We can keep only one, …when we say that 6 follows 3 and 9 follows 6

So, this is the alternate without with redundancy is removed, this is the network, this is with redundant. Now will my analysis change with this, if I have this vs this, this will my analysis change?.

Student: When you actually do it the early start you look, when you are looking the maximum, it does not…

Ok, it really will not change, but when you have redundancy calculations increase, your network complexity increases. The number relationships are more and it becomes difficult, not only for the computer to handle it, but we are trying to decide for the network just this lot of relationship around and it becomes more difficult. So, you can check you know and see if there is any change in relationship and any change in analysis due to the relationship. But you will find that if you start defining relationship with redundancy this is a lot we can continue keep defining in a real project.

Student: Sir, if like activity one is so large that 3 is very small (one see it this resources and the resources. So, large then where it might affect then what with what now I think course completed when you see correct completed.

So by saying that six will start only after three is complete, and three is will start only after one is complete, makes three the controlling factor. So, now, if you take this networks, so now compared to the earlier network, there is a lot more zigzag in this, that is the relationship is flowing in different directions. So, let us a put this network up in try to solve it. I am tempted to after do this otherwise it going to trouble.

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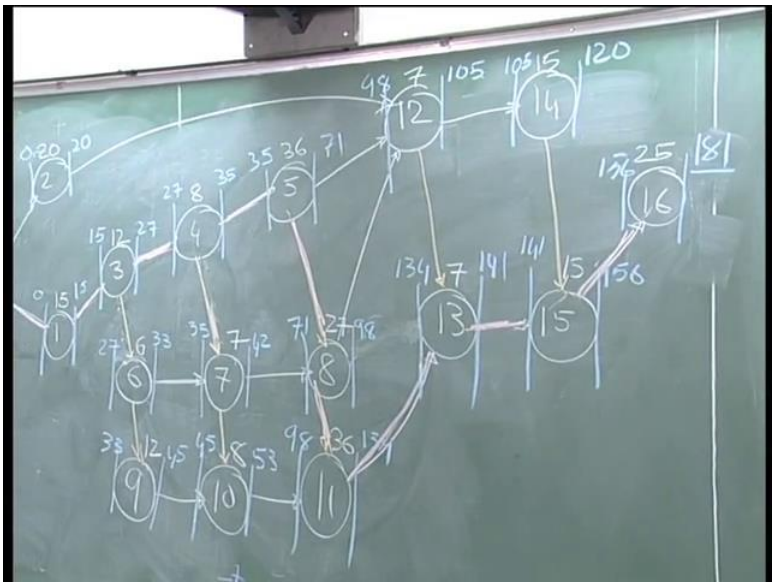

Have my start as earlier. I have 2, I have my 1, I am not going to this, earlier I had six, this time I am going to have the 6 come from 3. Now I go so this was piling, this was pile cap, and do this in a different color again ..is this redundant? 6, 3, 6, 7,.. 3, 4,7 think about it. So, now my relationship between 6 and 9 is also resource; 9 and 10 is a physical; so 11 this is up to the abutment from again 8 and 11 is the resource driven. My 2 and 12, this is the place beam on the east side. It requires 5 and 8. The crane that is going to be used there will be released and then I will only then I will be able to do 13 which is placed on a west side which is now 8 and 11. Earlier, we had a 2 to 13 relationship, is it needed?, not needed in this step.

Now once I do this, I have I can place a deck slab, but I have only one crew, I have to place the deck slab on one side, release the crew and only then the deck slab can be placed. I had a 14 to 16 relationship not required again. So, I got rid of these redundant relationships. Is there is what about my 8 to 13, unless if I am doing a 11 it means, so

Student: It is not required 8 to 13…

Not required, because if I am finishing 11, it means I have finished eight. So, this is relationship is also not needed. So, as a network gets more complicated and as we start bringing resource flows into it, you have to look out for redundancy in the process. Durations are the same. We have a 15, 20, 12, 8, 36, 6, 7, 27, 12, 8, 36, 7, 7. Let us go through the 0, 0. So, we go through this path this is the, so you have you can visualize this, this is the east side; this is the first side to get all the resources. So, we are going to

go through with this without a yeah 35, 71. So, now, this starts at 27, 33. Now I have a predecessor here

Students: 35, 25

So, now, this is controlling, 35

Student: 42

42 right. What is 8?

Student: 71

71, it is going to now be been 71, because it there is waiting. So, what does this imply that means, a pier is finished I am sorry the pile cap is finished, it is waiting for a the crew from the abutment of come and finish this, 71, 98. What about yeah have here done with this now we are waiting for 12, I can finish 12 I am right?. What was the duration, we got in the earlier project?

Student: 118

118, since we something which is changed here 33, 45. So, now, 45, 42, 45, 134. And here we have 134, 141 correct, yes 141. So, this is so now, we have 105, 141,1 56. So, is the critical path Obvious?, how does it go? I mean when I compare it to the earlier case, the earlier case we could physically see how the critical path went., should we do the backward, so we go through 1, 3; from 3 what happens, it goes to six or 35, I think it goes to four actually we should do the backward pass, but let us try to make a guess we can see., 35 is controlling here. So, goes to four comes down here and here what is controlling?

Students: …..

No, no, let us stop from here. We go this 156 is controlled here and this 141 is controlled here and 134 is coming from here; 98 is coming from up here and this is coming from 71 coming from up here; 35 going through this. Now here there is a float, here is the float. So, the actually critical path goes this, this, this. So it so at a certain stage, it crosses from one side of the bridge to goes all the way across and this is happening at which physical requirement?

Students: After completing…

The abutments, are what is time consuming and they are resource hungry. so we have got

the critical path you will be able to find that I want to do the calculation on the float, the various floats and when we start the next class we will briefly discuss the values you got and issues like how can resources be managed which is a broad discussion. We have a separate lecture on resource management and resource allocation. And how can resources managed and how do we actually do what we want to do on a project with this. Just have a curiosity of management which network do you prefer?

Students: Why?

Students: better resource we can complete it earlier.

Look at the duration, look at the duration. What was the earlier duration?

Students: 118

118 right, so it is a lot more days because your resource constraints accepts them. So, now, again we start now here there is a lot of a what do you call opportunity for parallelization if you want to bring the duration low. Now 181 days is not acceptable?…

Students: We will have to get more resources

We will have to get more resources or can I do there are many ways? you can do it; in fact we are assuming only one shift of work, or something you do multiple shift with same resources things like that. I will actually take this up more for discussion there are quite a few interesting patterns in this network. For example, you will find when you get into float, here you have in the other case how many activities are critical? Almost all were critical except for a handful. Here there is only what 1, 2, 3, 4, 5, 6, 7, 8, 9 critical, there are quite of few of the critical path 1; two here the critical path is not so, so after I actually get my get my east span yeah placed of course, it gets critical, but for a example this deck then becomes non-critical. So, there has to be a very close management of the network to understand what is critical, what is non-critical. If we accidentally or in one of these let us say you exceed the duration, you exceed the float then the other path becomes critical. So, these kind of issues, it requires closer management the network and that is acceptable because you are using fewer resources.

So, we will start the next class with the discussion on the float you got on this, and any questions you have on the floats. And how we would you use the float to be able to see, is there any pattern or what we can do from project management.