Project Planning & Control

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Lecture – 25

Lesson -07

Two-Span Bridge; Network Analysis

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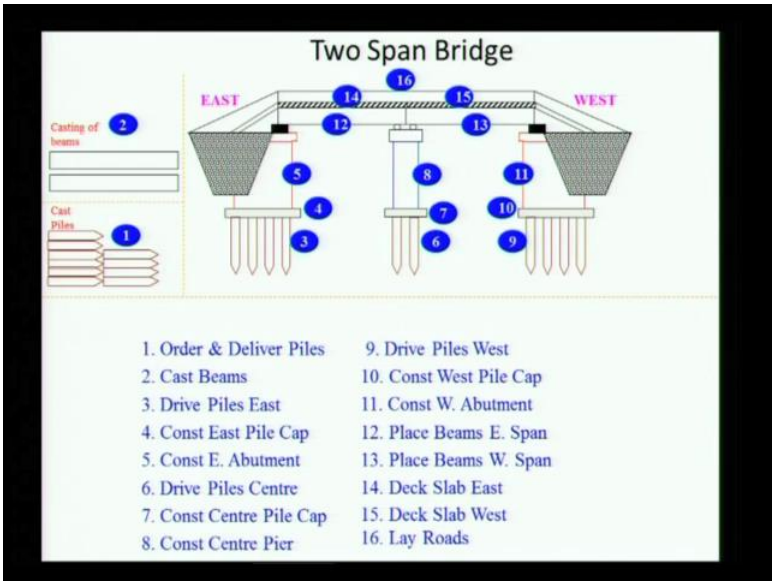

Now we go to the problem which we want to discuss, which is the two span bridge and you remember this we have 16 activities in the two span bridge.

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And we had actually talked about how do we calculate the duration of these activities and where we took for the example this was the construction of the pile cap; we talked about the various sub activities involved in the pile cap.

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And then went out to calculate the duration, we have this any question on this because we have done this ? mostly from a power point perspective, but if you have any question at this stage, I want to clarify, I will be happy to discuss it. And then we move onto actually using this duration So, just take a look if there any questions on this, ask me, let me clear the board ((Refer Time: 01:08)). So, any questions on this issue, no?

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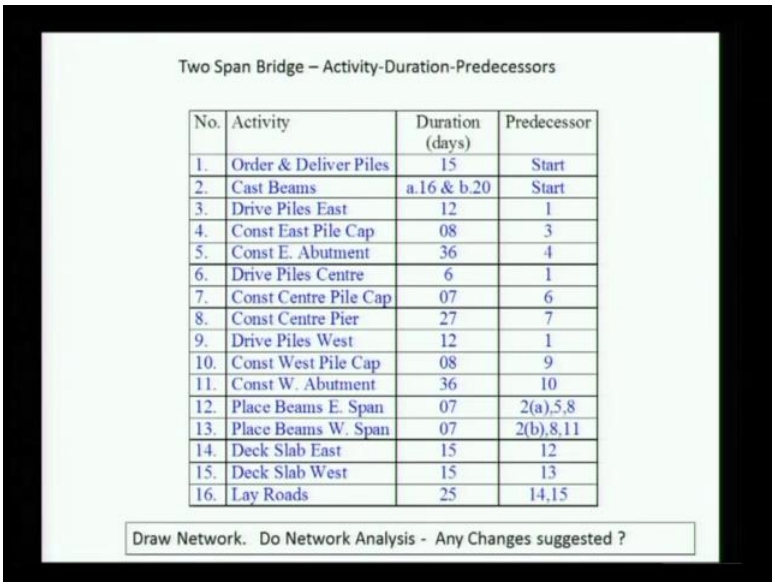

No.	Activity	Duration (days)	Predecessor
1.	Order & Deliver Piles	15	Start
2.	Cast Beams	a.16 & b.20	Start
3.	Drive Piles East	12	1
4.	Const East Pile Cap	08	3
5.	Const E. Abutment	36	4
6.	Drive Piles Centre	6	1
7.	Const Centre Pile Cap	07	6
8.	Const Centre Pier	27	7
9.	Drive Piles West	12	1
10.	Const West Pile Cap	08	9
11.	Const W. Abutment	36	10
12.	Place Beams E. Span	07	2(a),5,8
13.	Place Beams W. Span	07	2(b),8,11
14.	Deck Slab East	15	12
15.	Deck Slab West	15	13
16.	Lay Roads	25	14,15

So, we will take the durations as this which was given which we came up with last class and I had asked you question and asked you to do the draw the network, do the analysis and we said are there any changes in where as we go about the network analysis.

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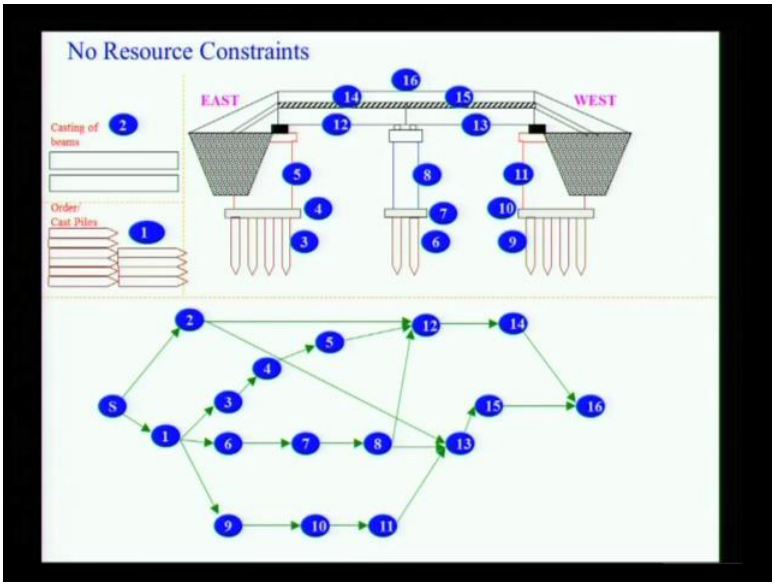

So, if we actually go back to the bridge, remember these network is our base network. And we develop this network based on what assumption?

Students: Resources are all available

Right, it is written there; resources are all available, so that is why we can do for example, 3, 6 and 9 are only dependend on delivery of piles or any of these it is all

depend we assuming that means, I should have piling rigs I can have piling rigs 3, 6 and 9 operating simultaneously.

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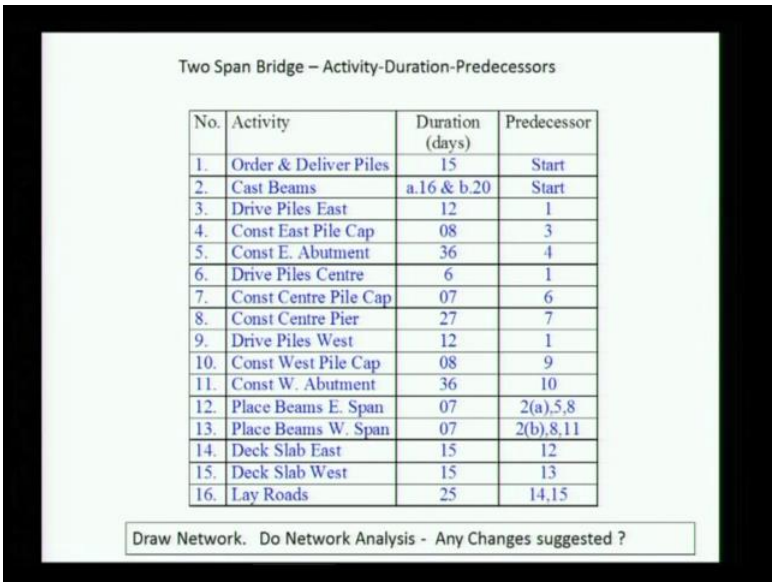

So, if we now take this network, so what I want to do is now that we have a group of activities which we can relate to there, they not just a, b, c, d. Let us do now network analysis with these duration; we will assume these durations are acceptable, if I go to depending on a project again go to some other project which someone doing with different method and I might say no, no this is not the duration I want or what. It might come out with different values for specific here, but we will assume these are the duration which we are doing with. And let us see what the project duration is, let us see what the critical paths are, how patterns evolve. And you will see that once we do this calculation, we will be able to kind of want to try to do this in a let see what are the techniques we would used to reduce the project duration.

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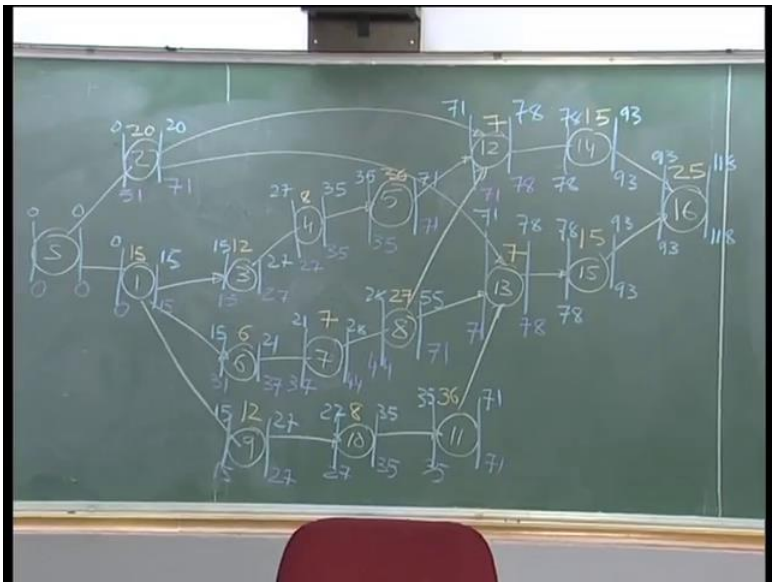

So, let us let me get this network on. So, you can also can kind of tell me the network is. So, that can that is this I was start two one ((Refer Time: 03:46)) to 1, 3, 6, 9.

Student: 3 goes to 4.

3 goes to 4. So, now, what is this chain of activities?

Student: They are abutment

So, this is they are abutment and things like on one side from…

Student: 6, 7, 8

8

Students: 8 to 13

since this is the…

Students: 8 goes to 12 as well

Yeah 8 goes to 12. And what is this series of activities?

Students: Centre

This is the center, this is the center pier. So, this is the series of link activities which are the east these are the linked activities which are the west, then I go to 9 to 10.

Student: 10 to11, 11 to 13

11 to 13

Student: 13 to 15

And then 13 to 15, 12 to 14 and both to 16 and 2 to 12, and 2 to 13. So this is the network. And if we actually quickly I mean, so that not dealing with numbers activities this was the deliver piles, this was the pre cast beam, this was the pile driving, this was pile cap on each other sides. This was the abutment the pier, placing the beam you need at the abutment the pier and delivery of beam, the delivery of the abutment, I mean the pier the abutment for the other side the laying of the deck and then finishing the route. So, I hope we can relate to these activities as we go. We should not this look at this as number.

So, we would start with now I will put out the durations which I had. So, this was 15; this we had two durations for each side and taking the final duration which is 30. Drive pile east which was 3 is 12. Let me go on the sequence then this was the each pile cap was 8. The east abutment was 36. You do not have this value 6. Drive pile centre was 6; construct centre pile cap was 7, and the center pier was 27. West was 12; we had a symmetry here; west pile cap was 8, and this was again 36. Placing the beam was 7; deck slab is 15 and lay road is 25.

Now without any network analysis, you saw the project, what you think will be critical. So, how many main paths do we have?

Students: 4

We have four, we have one going through 2; we are going through 3 like four main paths. Intuitively, what do you can you make a call?

Students: ((Refer Time: 07:55))

Do you think this will make a impact?

Students: no

No, so this is I am just trying to bring out the intuition rather than just look at the number, this will not make the impact. You have two sides at the center, which you think will be critical?

Students: Center

Center will be more critical except for we will see, we will see if the center is more critical yeah the only thing when you look at the durations remember the center has, so

this is 12, this is 6, 8, 7, 36, 27.

Student: The relative durations

Depends a lot on the relative durations.

Remember and this we are hitting all of the fronts parallel. So, it would really depend on which front it is like a race between three construction teams between it looks, so who is going to control the network for one who reaches the last, the one who reaches the last. So, that will depend on how much time each of these take in the, so that is a basic intuitive call. As the network gets more complex, it might be difficult to make this kind of call, you might have to go based on heuristic of you know for example, form work is always on critical activity on structure, so things like that.

But let us go ahead with the analysis. So, let us kind of work it out on the board, so that this is my start activity, I am going with again on 0, 0, 0, 20, 15. So, my piles have been delivered 15, 21. We will see a pattern emerging .

Students: 21, 28

How much is that 55, 71 this one all the predecessors there; actually yeah 71. So again because this is the network which we can see we should be able to find the criticality of the path which so what is your observation?

Students: Two critical paths

Two critical paths, because we are trying to do exactly the same. The middle path the only reason is not critical is because the durations all is. Now if the pier construction was in water and I had to do dewatering and this and that and lot of other things which made this higher, then you would had a probably a single critical path through the middle, because the others are different. And remember this is a again no resource constraint, because we going through it in a single sequence. Now let us go back 118, 93 actually I am going to change color on you here which would have like using a different color for this details; you can see what, it is pretty straight forward because so far, because and all through here and through here, it will be just the same because there is no float only when we come down this has going to be any float and of course, this 71. So, how late can I start?

Students: 44.

44. So, let me finish this path. So, to expand this one is 47.

Students: 37, 31.

So, 6 goes down to 31. Now here 71, so coming down here again 71, 35, 15, 15, 0,

Students: 71,

71, So, the network is we have the early start early finish, the late finish the late start. And we can see that likewise we discussed before we the critical path runs through and you have two critical paths in this case.

Students: 5 to 12

So, on all of these activities there is no question of float and the only the float will only come for so when we take 2, 51 is the, total float 51,

Students: Free float 51

Free float 51, 0. So, 71, 0, 20, 51 which means there is a lot of a we come down this, let us start with the another. So, we will take 6, 16, 0, 16, 0; this float 16, 0, 16, 0. Now will a have any is it 16, 0? 8

Students: 16, total float is 16

Total float is 16, what happens if I delay it, what happens with 13 or 12?

Students: Nothing happens

Nothing happens, 16. So, all of it is free float.

Students: Free float

0. What about independent?

Students: Independent, 44 minus…

0, because it is so nothing else is there to solve. So, are there any question on this? I think this should be straight forward. And I think you get the physical feel of what is important on the bridge. And again kind of accelerated construction, let us say we want to reduce the duration 118 is too much, let say we want to reduce it to 100, what would we do?

Students: I will allocating more resources…

Yeah So, right now is there any for the parallelization one can do, can I see I am pre casting the beams, and there anyway because of that is see if I have to cast the beam in place, that would have added mode, one more activity here. So, by pre casting the beam,

I am doing parallel. I could probably do something like some kind of a deck here which I could reduce time. Anywhere whatever I am talking about only way I cannot change the construction method, so drastically in this particular case. I could probably parallelize sum of my road construction, instead of waiting for everything we get over I could say that I am going to do start road construction in a particular phase and then only do it is a ten days of road constructions which is over the bridge something like that I could probably. So, again parallelizing is one way.

Other way is simply to reduce the duration of which means more resources different kind of materials. So, all of these I could staying so if you will see 36, 27 this is probably the largest duration activity right.

Students: Yes

So I could which is controlling and on critical path. So, if I can I mean it will be probably easier from it to get a chunk out of 36 then out of 8. So, I would look at trying to reduce duration of these 36, I try to reduce the duration of 25, 15 see if I can and we will take this up later, how do we compressive a project. Any questions? Now we are going to start doing the same analysis, but with the resource constraint. We want to model the resource constraints in the network, and when you do that, we can then compare how the critical path changes and what happens. So, this is probably the one alternative, and if you go into the real world all parallelize rarely used; only on probably the most urgent of project that we would even consider using something like this.