

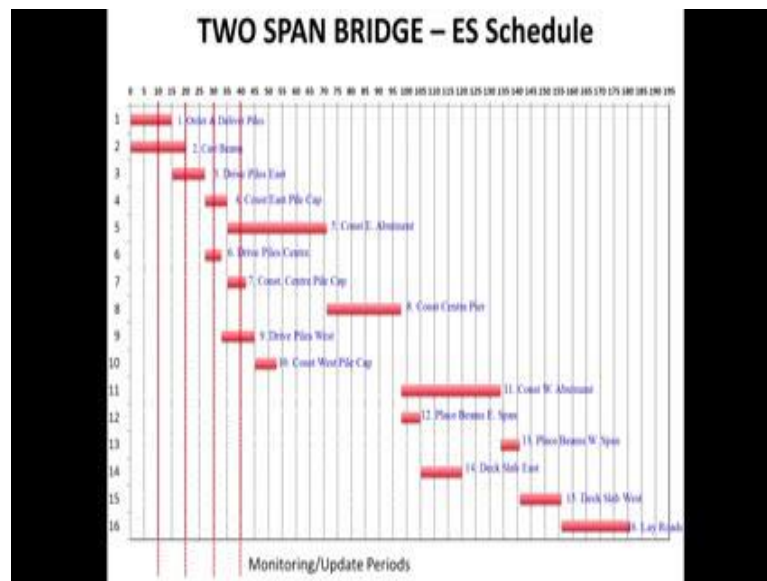
Project Planning & Control
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Lecture – 48

Lesson - 09

Application Two-Span Bridge - ES Schedule

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Now, what we going to go is, go a little bit into depth is how do we get monitoring data. So, I would be actually going back here to the two span bridge examples which you are all familiar with. I think it was lecture eight, where we went into in calculating the duration of the various activities is of this bridge; and I think I have taken those durations and put it in a bar chart here. I think, many of you might have done this already. And we have the various activities here in the bar chart, you can see the activities- the way I have listed this, but the bar chart shows the early start schedule. What we are going to do is, now we want to take monitoring.

So, we can go to the discussion; how frequently would I monitor this project? Should I monitor it every day? And again, please remember this is the monitoring as far as the macro schedule is concerned. I should monitor things on a daily basis and that is for the micro schedules, there is no doubt about it, I should be getting a daily progress report. But, if I am going to update my network schedule, how frequently should I update it?

And for that do it on a daily basis might not be a required, I get choose, I am going to do it every 5 days, 10 days, 15 days, obviously, let us go to some extremes; obviously, it is.. does not make sense for me it to review it every three months for example, does not make sense for me to review every three month. Because within two updates the project will be over, and if I do not know the status of the project in my first update or if I only know status of my project after three months some ,things are happening, some things are not happening, that is really not and it is not enough time for me to do control action.

Whereas, if I go to try to schedule on a day, I mean try to update it on a daily basis, the overhead of getting the data, and then I have to have too many meetings and then we will have more meetings than actually work getting done. So, we have here selected an update every 10 days and that seems reasonable for a project of this, might be if people are extremely familiar with the project might even be you can even take it every 20 days or even every month if the project is a very standard kind of project as this kind of turns out to be. But, let us for illustration take every 10 days, it is kind of a nice period to do. And please I would like to also mention one more thing, in this schedule we have taken it has not calendar days but continues days. If you put this on to a professional software and put a calendar on to it you will find that the day scheduled changes based on holidays and other things.

So, here we are.. so if you tried to put this to Microsoft project or Primavera, you will find that the calendar then comes into play and the dates.. the days will certainly change; the duration project will increase. Here we are just working continuously through all the days. So, coming back, we are taking a monitoring update period of every ten days and what I am going to go forward is, I am going to take this - what I have circled here this set of activity because just for illustrating I am going to take this set of activity and go forward with that.

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So, here we are, so this is, I have got about thirty-five days of activity zoomed in over here and we have six activities listed. So, you can see ordered delivery pile, cast beam, drive piles east, look at the east pile cap, east abutments and the centre piles. And you can see the planned schedule on each. You can see the schedule from the early start perspective. So, this has gone from, 15, 0 to 15, 0 to 20 and so on. And if we wanted to update the schedule, how do I update? So remember, my monitoring is on every 10 days. So, here we are now let us say we are ten days into the project, and so on the 10th day, I want to do an update. So, what is the data I am going to look for? So here we go, I have put up a table as a typical data that I might collect.

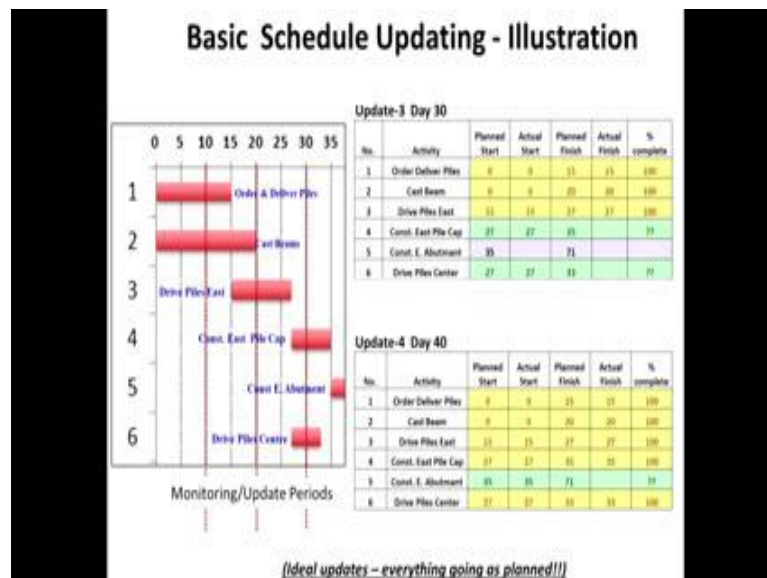
So, my first two activities which are ordered and deliver piles have started. And, the planned chart was 0, 0, my actual chart So, here we go I am kind of going in this exercise, here I am going to assume everything is ideal; everything is going as planned. I am only illustrating where the values go, not likely to happen, but exactly as I have illustrated it, but this is again more for illustration sake. So, planned start is 0 0; actual start is 0, 0. Now I am at the tenth day. My planned finish for 1 and 2 is 15 and 20. So, they would not a finished yet, but they will be progressing. So, I have recorded here that they have started as planned; they have not yet finished, but what I need to do here is, then on the tenth day what is my percentage complete on the first activity, what is my percentage complete on the second activity? I should be able to enter the value there for as an update. Now ,my other activities are not yet started; because I am on the tenth day and so they do not come into play for this update, but the question now is what do I enter

for these two. We will answer this question in due course.

Now, I move on to the second update which is on day 20. So, on day twenty, my second update. And here we can see that by the twentieth day if I look on my schedule activity 1 and 2 should have been completed. And here you can see a completed and now I am actually able to enter 100 percent complete because they have been complete. But in the earlier phase, I was not able to enter percentage complete, because they were half way through. Once I completed, it is easy for me to enter; and of course, once if an activity is not started also, it is easy for me to enter 0, 0, 0, 0, but.. so 0 and 100 are ok to enter. The challenge is how do I calculate the percentage complete in between.

So, here when we look at the update on 20, so we are on this, this line here, and we can see these two activities are complete and drive piles east is going on; drive pile east is going on which is highlighted in green here. It started as scheduled; again the question is I do not know, it made progress, but what is my percentage complete? The other which has not started are again of course, 0, 0, 0 as far as because nothing has be started on. So, it is just an illustration of what a basic update could be, and the key here is for us to focus on..the key update information is percentage complete of activity is that are in progress. How do I actually get that done?

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We now move on to, the same thing continues, I have gone to update 3 on day 30. Once I have gone to day 30 here, you can see that the activities that are active, first three activities are over; east pile cap and pile center are activities which need update, and east

abutment is not yet started. And when I go to 40, which is five beyond here, all the activities, assuming everything is going as planned, all the activities, except east abutment have been completed, because we are going as per plan. And east abutment, I still need to know how much progress was made. So, this is an issue, how do I enter the percentage complete of an activity.

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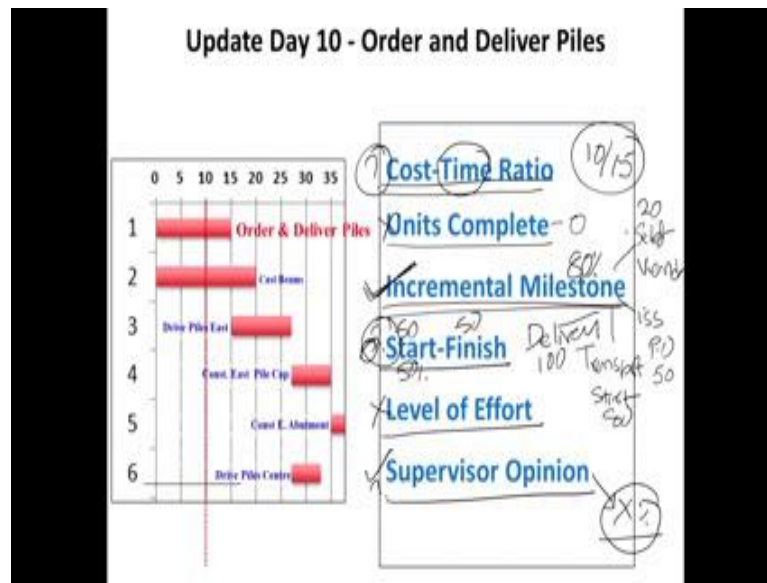
Work Progress Measurement (Estimating % complete of an activity)	
Method	Approach
Cost-Time Ratio	Proportion Spent vs. Total
Units Complete	Units Completed/ Total Units
Incremental Milestone	Define & Monitor Milestones
Start-Finish	Start & Completion Milestone
Level of Effort	Weighted Sum of Sub-Activities
Supervisor Opinion	Opinion of Supervisor Who is Responsible for the Work

Now, so there are methods - specific methods by which we should be able to enter percentage complete of an activity. And here, I have listed few of the popular methods or much-referenced methods. And, we will see how these methods are applicable in a specific situation. So, the first method is a cost-time ratio, where what we basically doing is the proportion of cost at a time versus total, I will explain this through an example later. Units complete is a very direct method where we are saying if I have 100 units of work and if I finish 50 and then it is 50 by 100 is my percentage complete - straight forward. Incremental milestone or seemingly straight forward I should say. Incremental milestone is, I take an activity like procurement or design or I put milestones in between if it says procurement, I say purchase order issued or purchase order issue acknowledged, item shipped. I put the milestone in between and based on these intermediate milestones, as they reached I can then say 'ok if the item has been shifted I am up to 80 percent complete'; if it is going to be cleared, you have this percentage complete'. So, I would be identifying milestones for which I would be defining my percentage complete based on.

Start-finish is even simpler. It is a start milestone, finish milestone, if something starts, I say as a specific percentage is complete; finish I say hundred. So, either 0 before it starts

or 100 after it finish. This is the basically start completion milestone. The level of effort is an interesting technique, I will be showing this little more in detail in as the example proceeds, so but just in an abstract way, it is a weighted sum of sub-activities. We will give an example for this. And of course, there is also the opinion of an experienced supervisor to be able to give their opinion on how much they think the percentage complete is. So, these are the typical techniques. So, let us just apply some of these and see what is applicable to the..the example which we just discussed.

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So, lets us say we are on day 10, and we want to update the status of the order and deliver piles. You may recall there we on day 10 we had put a question mark, what is the percentage complete. So, how will I actually measure percentage complete of order and deliver piles if I was on day ten? So, one option is, if I am using that cost time ratio and this particular case, I will be using time. We are basically saying the activity is 15 days, and we know the duration of activity is 15 days and 10 days are over. So, the percentage complete is 10 by 15. You have to decide if that is a fair assessment of percentage complete or not. Obviously, it might not be a fair assessment, because we are assuming that the progress of this particular activity is proportional to time spent which need not be the case, so that can be I mean you actually need information from the activity to do this. So, this is not a very good indicator of percentage complete for this particular case.

What about units complete? For order and deliver piles, if I am on day 10, might piles delivered zero; if I am going to take units complete, I will get zero as an answer, might not again reflect actual effort that has gone into this order and piles. What about

incremental milestones, so this seems I am some application to this particular activity. So, I can take order deliver piles and break it into milestones. For example, I can say a select vendor, and if I issue a purchase order, transport, I can have series of milestones. And then, as each milestones, say select vendor and I might say 20 percent; issue purchase order, I might say if I have issue purchase order 50 percent of their activity is complete in milestones. Once I go into transport, the start of transport, I say 80 percent; and delivery, I will say 100 percent. So, I have 20, 50, 80, 100. On day 10, I see what as happen, oh transport has started, and then I will say 80 percent is complete, so that would be an incremental milestone.

Start-finish is another option, but if I am going to use start finish in this particular situation, the answer is zero. I mean yes, might be something has started, but the answer is basically, or I should say because it is started I would give it say 50 percent for it to start, 50 percent for it to finish. So, I could say yes, the activity has started, I had issued all this. So, I am giving it a 50 percent, it is a possible way. The level of effort does not easily, it can apply to this activity in this sort of way; if we break it down into milestones and put numbers on it, but will illustrate this for the next activity in, it is more appropriate for it. Supervisor opinion is certainly way we can get this, obviously, supervisor opinion will apply to any of the activities, but in this case, you can ask the experienced supervisor what is the status of the pile order and delivery? And he or she can come up with this opinion and say I think it is a person, because I got assurance from the supplier that will be here in a within a day or two or whatever so, you can get an opinion of this.

So, if you look at this particular activity, we know that units complete cannot give us a good answer. Cost-time ratio, I do not think can give us a good answer. Incremental milestone yes; start-finish might be, but we need to get this from. The level of effort, in this particular case, I think it is too detailed for this activity. Supervisor opinion, yes, may be depending on the expertise of the supervisor. So, if we are we have to choose and I mean if I would choose I would give incremental milestone the most appropriate way of finding percentage complete of this particular activity.

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2. Cast Beams – Duration (Lecture 8)

Beams are prefabricated in casting yard set-up on site.
No. Beams required is say 3 for each span- total = 6

<p>No. beams required = 3 + 3</p> <p>Operation Sequence:</p> <ul style="list-style-type: none">1.0 Reinforcement Fabrication – 2 days2.0 Casting Beam<ul style="list-style-type: none">2.1 Formwork Assembly – 1 day2.2 Concrete pouring – 1 day2.3 Form removal after – 1 day2.4 Form removal time- 1 dayCuring before usage – 28 (14) days regular 3 days steam curing <p>Assume reinforcement fabrication is done in parallel</p>	<p>Production Rate – based on No. Forms/Beds</p> <p>No. Sets of forms</p> <ul style="list-style-type: none">1 1 beam in 4 days -> 24 days for 6 beams2 2 beams in 4 days -> 12 days "3 3 beams in 4 days -> 8 days " <p>What production rate is required?</p> <p>Assume 3 sets of forms:</p> <p>Total Duration= 2 + 14 (1st set); Day 6 + 14 (2nd set)?</p>
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Now, let us take the next activity which has cast beams and we can do the same discussion. So, now cast beams we, remember that this was something which we broke it up into sub-activities as earlier. So, let me just go to the remember this, this is from lecture eight, when we were a going to cast.. even we were calculating duration for beam casting please referred to this; we broke it up into very much more detail, please keep that in mind. So, now, when we come back to the cast beam activity here, and we say that I am on day 10, if I use cost-time ratio or mostly time ratio, it should give me 10 by 20. Or, if I use.. that is.. so that should say 50 percent complete. If I use units complete; obviously, no beams have come out by 10, no beams have come out, so it will be zero. If we go back, the first set of beams will come out after 16, so units complete is zero.

Incremental milestones, yes, I could use incremental milestones if I defined proper incremental milestones along this process like in a setting up the bed, pouring concrete, I could do this. Start-finish could be done again, because in this particular case because it is simple it could be done, but might not be so easy to define, once I got my formwork and everything in place, I will say I have started, and once the beams are finished, after the twentieth day I can say I finished, but still we want a more detailed way of being able to assess the percentage complete. So, we will actually use level of effort on this, I will illustrate the level of effort with this. And of course, in this case also, the supervisor being a can have.. can be something which they can go back. But let us go into the level of efforts, so if we are recall again these were the various activities, which we took in the cast beam in calculating the durations. What we have done here is put these activities

in the form of a daily schedule.

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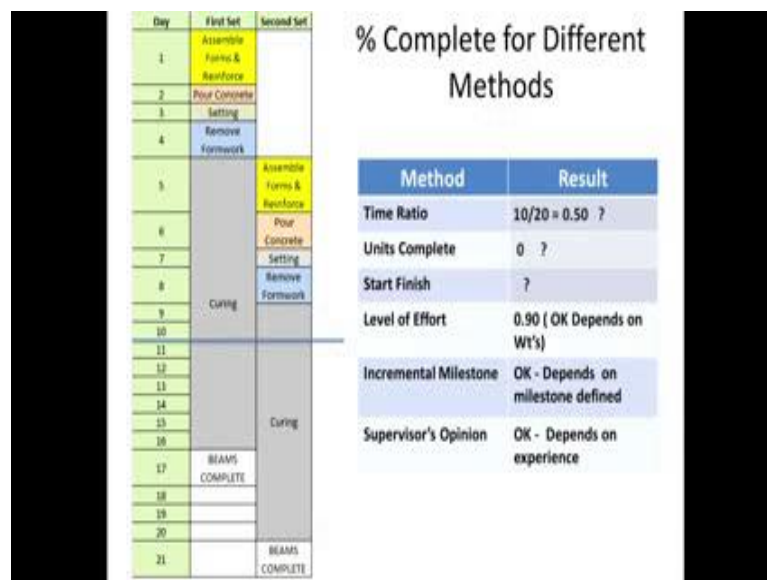
So, now if we went to the micro level. So, because we were able to get these in the form of a daily schedule, we are actually go able to go the micro level. And, you can see at this micro level, what we have done is, we have the first set of forms that is here, the second set here. And we have gone on a daily basis and said what is happening at on each day, and as we go in through each day we can see that see here, so here is our update day, remove formwork, the beams get completed early here. So, if I am updating here with units complete like we said, no units are complete. And, we have had this discussion. So, we are not able to..to be able to get the exact way; what we are going to do is, we are going to.. what we use called the level of efforts. So, in the level effort approach, we are taking each of these activities and giving it a weighted based on the effort which we think is required. So, here we have, see assemble and reinforce we are saying as 0.5; pour concrete - 0.2, setting 0.1, remove formwork - 0.1, curing - 0.1. So, this is the weightage I am using for each of these sub-activities within the casting beam activity.

And, what we then do is go ahead and for the update period of 10 days, we are looking at.. we are putting, so here you can see I have introduced the weightage as a column here and sum of all the weight should total 1. So, we can see that totals 1. Now I look at quantity complete, how many beams have already being assembled and reinforced by this day you will find this set as been assembled and reinforced as well as this set. So, they are of value is 6. Pour concrete, in 6 sets concrete as been poured. Setting also all is six, setting is over, by the time, I have completed. Remove formwork all six. Curing,

both are undergoing, curing until it is set. Curing right now is zero, but when it comes here the first three would have cured, and when it comes here the next three would have cured. So, right now it is zero. So, now, what we do is take a weighted quantity, that is we are taking the quantity complete for that particular sub activity into the weightage of that sub-activity and this column gives you those values and you totals up to a value of 5.4.

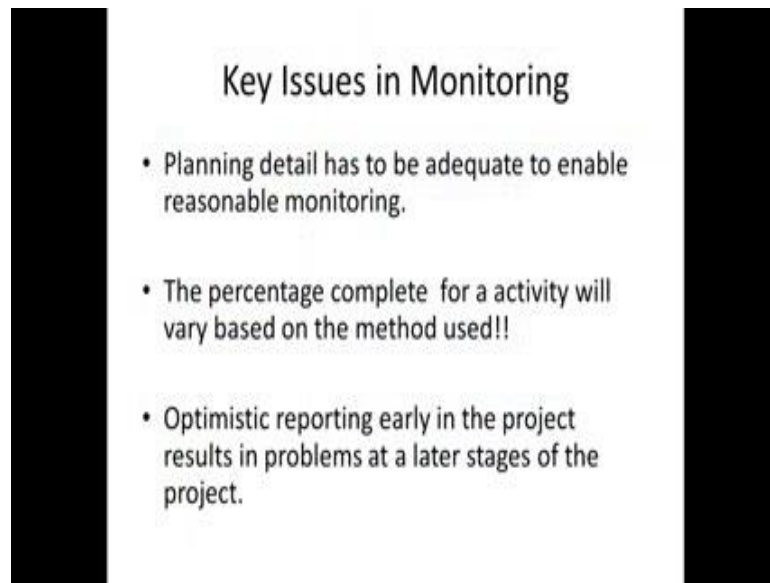
So, basically through this level effort calculation, I am saying that 5.4 out of 6..that's 5.4 out of 6 beams have been completed, which works out to a percent complete of 90 percent. So, now, this could be more reasonable value to enter as percentage complete of the activity, but it requires some amount of calculations in being able to assess weightages and being able to break it down into finding out what particular sub-activity is completed during the update period. So, it is also probably, you will realize if you do not plan in this level of detail, you will not be able to monitor or you will not even be able to get a benchmark at this level of detail. So, it is still a macro plan, I want an update on the tenth day, and I am going to be able to get 90 percent complete, whereas if I had used some other techniques you get different values.

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So, if we actually compare the various values, you will see that the units complete, you get zero; the level of effort, you get 90 percent complete; incremental milestone depends certainly on the milestones defined. And on the supervisor opinion also, it certainly depends on the experience of the supervisor, but the level of effort in this particular case as given as a very systematic way of getting the percentage complete.

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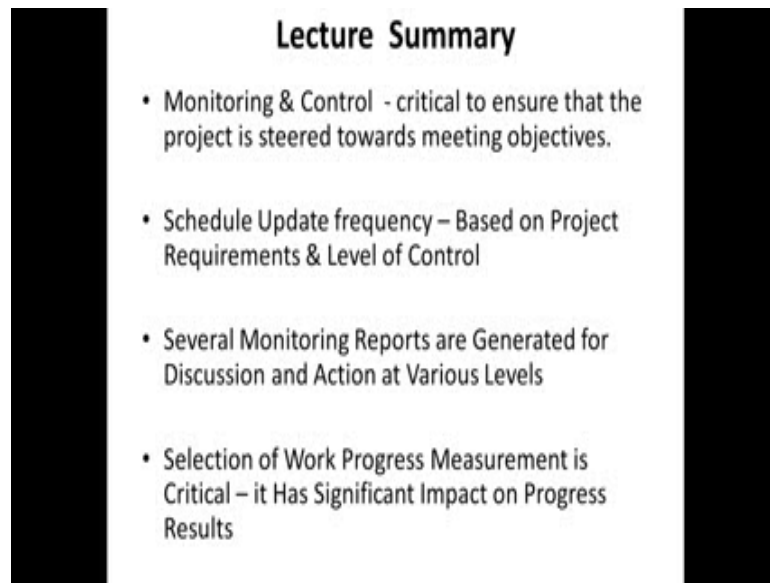
Key Issues in Monitoring

- Planning detail has to be adequate to enable reasonable monitoring.
- The percentage complete for a activity will vary based on the method used!!
- Optimistic reporting early in the project results in problems at a later stages of the project.

Now, to kind of wind up, some of the key issues in monitoring- we have a kind of seen here. like planning detail has to be adequate to enable reasonable monitoring. If I simply suggested 20 days, as the duration for beam casting, beams without the level of detailed and planning, it will be a little more difficult for me to have a structured way of measuring the percentage complete of the activity. So, the more detail we have or the adequate level of detail is required for establishing a good monitoring system.

Now, we have also seen based on the earlier example, percentage complete will vary based on the method used; this is a really a tricky issues. This can be used by the planning engineers; sometimes to be to be very optimistic on how the project is progressing. And if you have sometimes too optimistic in the early stages of the project, you will find that it is the whole realism comes only in the later stages and things will catch up with the whole team if the reports are only optimistic. But this issue of which method to use to appropriately capture the actual percentage complete is really an issue and probably a bit of experience, a bit of judgment is required to be able to use a correct method for the activity.

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Lecture Summary

- Monitoring & Control - critical to ensure that the project is steered towards meeting objectives.
- Schedule Update frequency – Based on Project Requirements & Level of Control
- Several Monitoring Reports are Generated for Discussion and Action at Various Levels
- Selection of Work Progress Measurement is Critical – it Has Significant Impact on Progress Results

Finally to summarize, I hope you all appreciate that monitoring control is really critical and to ensure the project is steered towards the meeting the objectives. So, without the monitoring and control phase, we will not able to bring the project to meet its objectives; just planning alone will not do. And it is very common to see detail plans developed, but the monitoring phase is just left to what the site teams thinks, and there is no real planning team involved in the monitoring phase and that to be able to get large projects in on to meet objectives, we really need a coordinated effort to do that. We talked about the schedule update frequency; we said, it should be based on project requirement; we said it depends on the level of control, the level of the plan. Certainly, all projects have some kind of daily update of the micro plan. But, when we come to the macro plan, what is the level of update will have to be decided again based on requirements and judgment.

We looked at some of the monitoring reports, but this, there are several formats available there are several requirements available, but rather than use of format, please understand.. you should understand what the information is being used for what decisions will be made with the information, and based on that the report should be generated. And in the last topic, we found that the work progress measurement is important and this is at the heart of the monitoring system, how you are measuring the progress of work. If there is incorrectness in the way of work progress is measured, obviously anything else that uses that data will not be able to reflect the project correctly. So, it is extremely important that the work progress measurement reflects the field measurement or what is happening on the field accurately and cannot say more about it,

because it is really important and this is where a lot of the weak links in the planning and monitoring system are. With that, we will look forward to your questions and discussions on this topic.

Thank you.