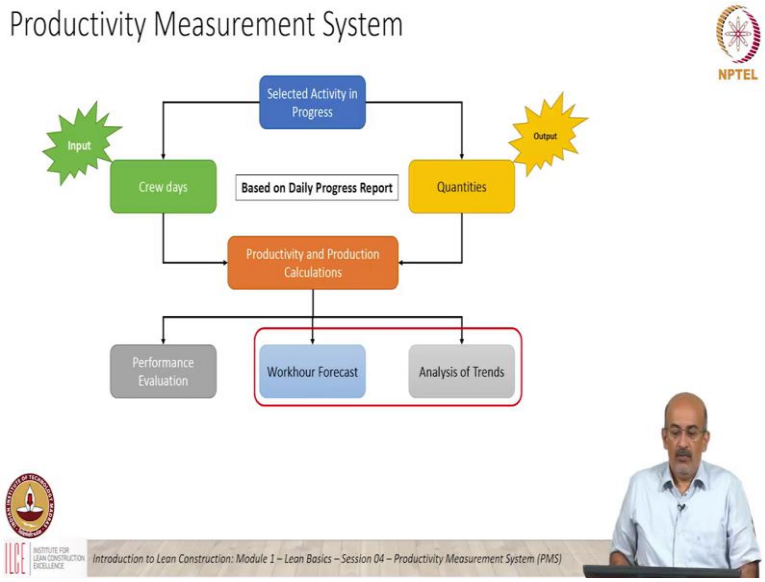
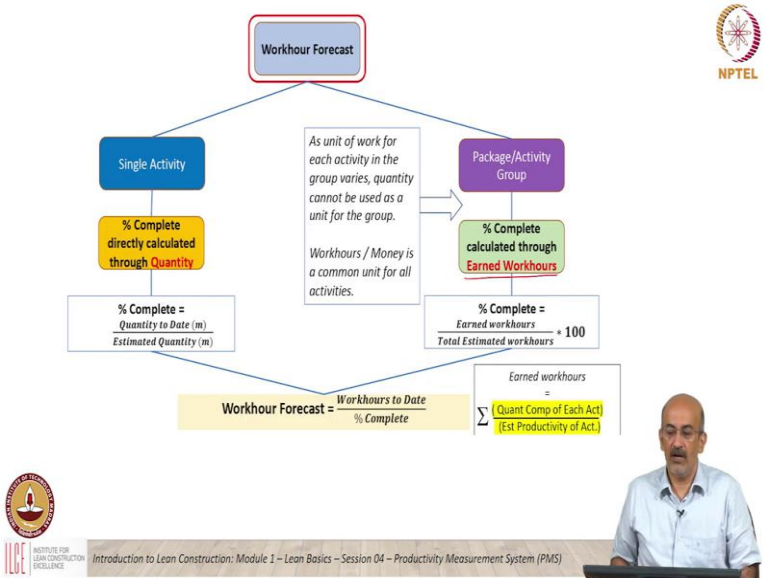
Introduction to Lean Construction
Professor Koshy Varghese
Department of Civil Engineering
Indian Institute of Technology, Madras
Module – 1, Lecture 22
Productivity and production Calculations:
Workhour Forecast and Analysis of Trends

(Refer Slide Time: 0:22)





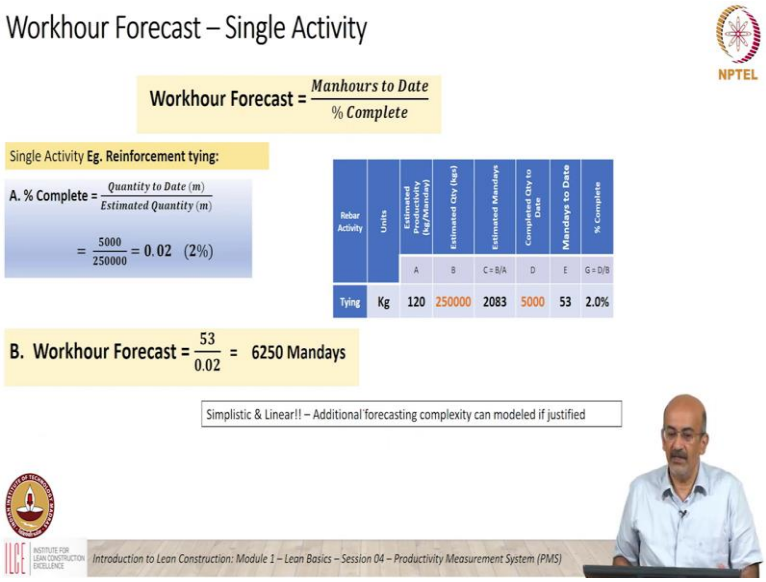
Now, we move on to the last part which is on forecasting workhours and analysis of trends. So, again coming into productivity measurement system. When we look at workhour forecast, we can look at it from a single activity perspective or a group of activities or a package perspective. So, when we take a single activity, the key is how you calculate percentage complete.

And for a single activity it is fairly straightforward a percentage complete is quantity to date divided by estimated quantity and we do our workhour forecast by taking work hours to date divided by percentage complete gives you the forecast of work hours. When I say work hour it could be man hour man day, crew our crew day but we are using the term work hour generically here.

Now, if it is a group of activities, it is not you cannot calculate percentage complete by just adding up quantities because the units are different. So, as unit work for each activity is different, the quantity cannot used. The common unit actually for all activities his workhour or money, cost, money. So, we come into this concept of here we are saying earned workhours it could be earned money earned, cost or what do you say, it could be in that form, so here we are going to multiply by the work hours, but it could be cost into could be the same factor.

And we are calculating percentage complete here by saying earned workhours by total estimated work hours. So, where here is quantity by estimated quantity here, we convert all of this into equal and workouts and this remains the same. So, when we look at earned work hours basically it is quantity complete for each activity into estimated productivity of the activity. We will get into an example.

(Refer Slide Time: 2:24)

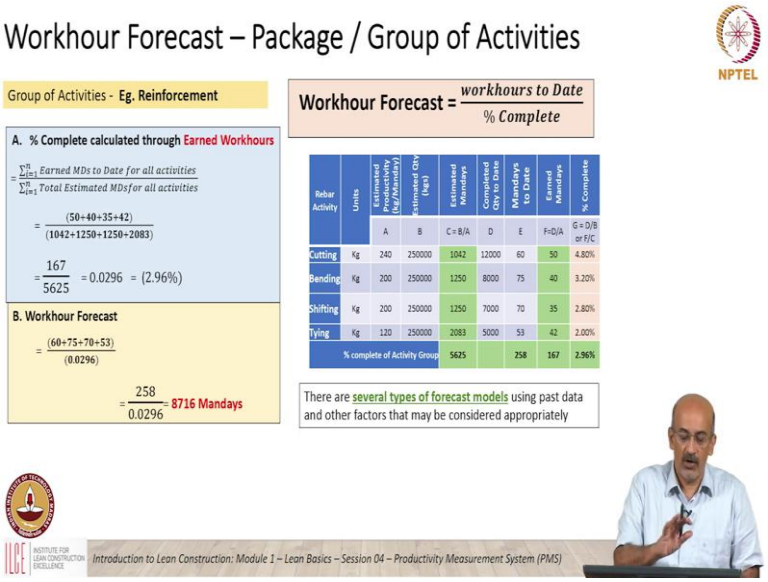


We take reinforcement, we are only taking tying a reinforcement for example. So, this is the total estimated quantity, this is the quantity to date. So, a quantity to date divided by estimate it is only about 2 percent complete and we are saying workout forecast is 53 divided by the 2

percent which gives us the predicted quantity, and this is definitely simplistic it is linear. We can complicate and they have taken a very simple example just to illustrate.

This can this this needs the formula or the approach remains the same, the values will get this is all based on one day's data. The values will get more, what do you say realistic as you get more and more data. But also it is a linear or a simplistic model itself the model can be more complicated if the data justifies it the factors identified, we will talk a bit about this after the next slide.

(Refer Slide Time: 3:26)



Now, we go into a group of activities. So, instead of having just tying let us assume that I am trying to measure percentage complete a reinforcement as a group of activities not a single accurate. So, while the units are still kilogram, kilogram, kilogram I cannot add up the quantity of so much of cut, so much of bend, so much shift, so much of tying and say that this is divided by this total value that would not give me a right view of the percentage complete.

So, what we need what we do here is we take the quantity completed to date, the quantity completed to date. So, let me go through this table in detail. So, you have estimated productivity kg per manday of each activity here. This is for cutting, bending, shifting and tying. The estimated quantity for all are remaining the same because the total quantity has to go through all this.

The estimated mandays is based on the relation between the based on the productivity and the quantity and this is the quantity completed to date. This is what is installed and I am taking

my measurement. My mandays is today, so this is the amount of time mandays actually spent to do this quantity, this is here.

Now, the completed, so now we take the concept of earned mandays, earned mandays is basically the completed quantity and the expected productivity. So, that is D divided by A, this is the mandays I should have spent for this quantity. This is a mandays I should have spent for this quantity that is the mandays I earned to install this quantity; this is the mandays I actually spent.

So, what happens here is, so when we look at the earned mandays as 167, the estimated mandays as this my when I look at it from the earned value concept, this is my total estimated mandays for, earned mandates for all activities divided by total estimated mandays, I get this value is 2.96 percent as my package completion or the group of activities.

So, for my work hour forecast what I have to do is take my mandays to date divided by my percentage complete and I get my projected mandays, let me stop here and ask you to clarify any doubts you might have. The typical doubt is what is an earned manday? What is it? What does the earned manday significant?

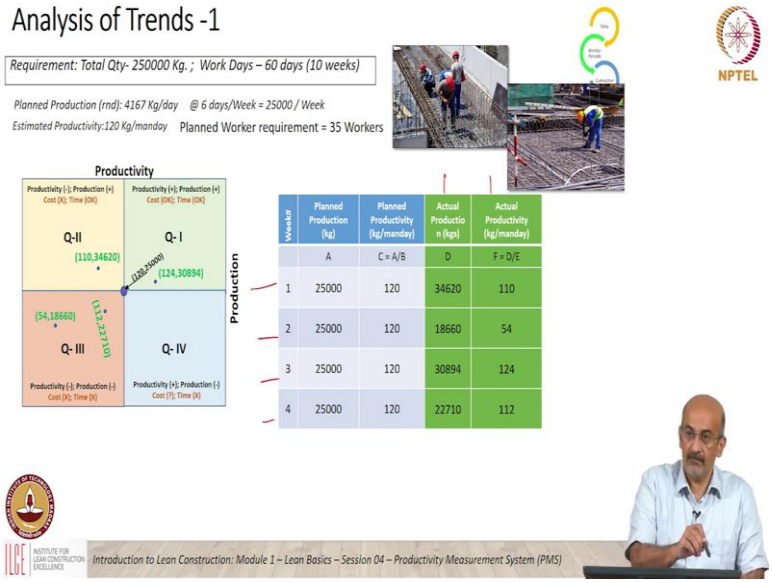
Student: What you should have actually used as per the plan.

Professor: What you should have used, so, as per the plan. So, I have spent 60 days, I spent 50, I have actually spent 60 days when I should have spent.

Student: 50 days.

Professor: Actually spent 75 and I should have spent 40. So, this model that is there are several types of forecasting models. We have again this is relatively simple compared to the types of models that can be used, when you use, so, here we are only using the mandays which have been spent and the expected productivity, but they can be things like weather, they can be things like or lot of calendar factors which can be brought into forecasting models. If these are available, and you have a proper model that is calibrated that could be done, but it has to justify the sophistication of the model. What we have here is a simple model.

(Refer Slide Time: 7:35)



When we go to analysis of trends, I think this matrix is familiar where we had production and productivity. And we want to now take the same example and see where is this going to, where, does the project if we take different weeks, here we have week 1, week 2, week 3, week 4. And we have actual production and actual productivity, where does this lie with respect to this matrix? So, if you remember we said this is a target value.

Student: Yes.

Professor: So, here is 120, by 25,000 is the planned production for a week.

Student: Yes.

Professor: So, this is one representation now compared to this, where does my first value like 110, the coordinates will be 110.

Student: Q - 2.

Professor: It will be in Q - 2. First one is in Q - 2, second one?

Student: Second one will be in Q -3.

Professor: Q - 3, third one is 124, 3086, that is Q - 1. And the fourth one is back in Q - 3.

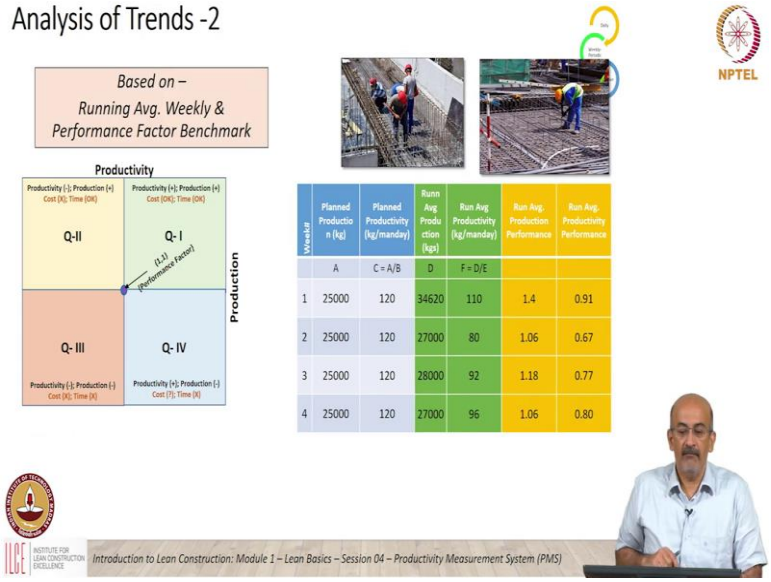
Student: Q - 3.

Professor: So, this is one way of looking at it. Does this give you the full picture? What is missing? What would you, how would you change this? Taking ideas we learned about

performance factor? How would you modify, so two things happen. One is this gives you weekly, this each week is independent. So, it shows you the where I am on the quadrant that week.

Based on what we learned a few minutes back. What would you, how would you one as I would try to do cumulative. I could not just put all these independent dots. I would like to see it from a cumulative aspect. Second, rather than have a value real number value here I would use a factor.

(Refer Slide Time: 9:50)



Week#	Planned Production (kg)	Planned Productivity (kg/manday)	Runn Avg Production (kgs)	Run Avg Productivity (kg/manday)	Run Avg. Production Performance	Run Avg. Productivity Performance
	A	C = A/B	D	F = D/E		
1	25000	120	34620	110	1.4	0.91
2	25000	120	27000	80	1.06	0.67
3	25000	120	28000	92	1.18	0.77
4	25000	120	27000	96	1.06	0.80

So, let us look at it from a running average perspective. And here, we have again it is the same information. So, here production and productivity.

Student: Q - 2 and Q - 1.

Professor: And we are now putting the target as performance back. It is a one-one target, which is a very, I mean, it is a simple target to relate to. And when we look at it, all of them are in the?

Student: Q - 2.

Professor: Q – 2, does this relate to what happened in the.

Student: Week wise now.

Professor: No, when we looked at the performance factor graphs, production was production was always above, productivity was below. It shows in the same. So, this is another way to

view the same information. And again, there is a lot of choice of what do you may called dashboards. It is up to the team to decide which dashboard they want to standardize on and be comfortable.

(Refer Slide Time: 10:54)