


Introduction to Lean Construction
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How to Start Practicing Lean Tools in Project Sites-1
Work Sampling

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Case Study – Use of Lean Tools

WORK SAMPLING

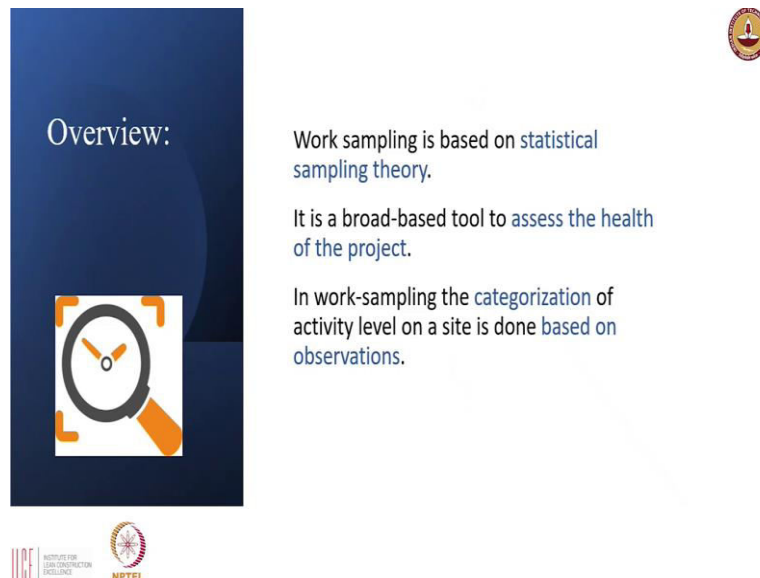
Godrej Construction

Ms. Diamond Barretto
Godrej Construction

The Work Sampling System.

Hello everyone, today I will take you through a case study done by Godrej construction on the lean tool work sampling, I am Diamond Barretto and I have been very much a part of Godrej's lean construction journey.

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Overview:

Work sampling is based on statistical sampling theory.

It is a broad-based tool to assess the health of the project.

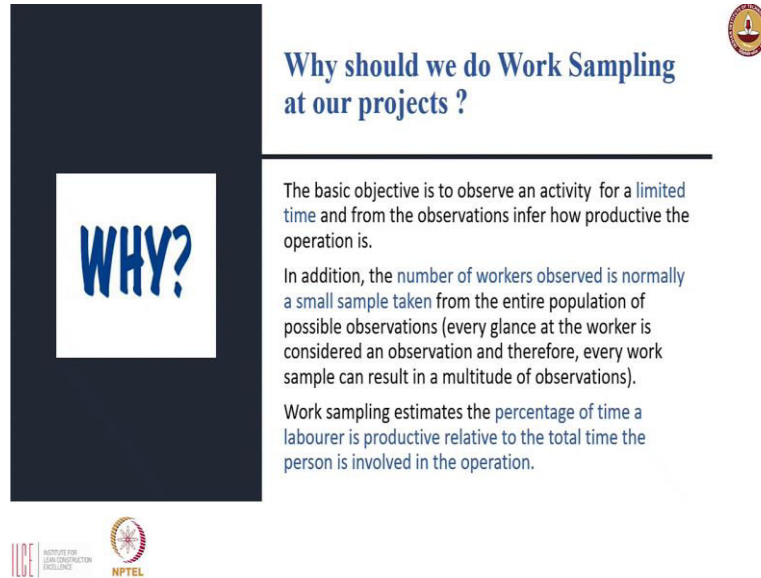
In work-sampling the categorization of activity level on a site is done based on observations.

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So, an overview on what is work sampling? Work sampling is based on a statistical sampling theory, it is broad based and it is used to assess what is the health of the project. So, work

sampling means categorization of activity level items, which are at a site based on a number of observations.

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Why should we do Work Sampling at our projects ?

WHY?

The basic objective is to observe an activity for a limited time and from the observations infer how productive the operation is.

In addition, the number of workers observed is normally a small sample taken from the entire population of possible observations (every glance at the worker is considered an observation and therefore, every work sample can result in a multitude of observations).

Work sampling estimates the percentage of time a labourer is productive relative to the total time the person is involved in the operation.



So, why should we do work sampling at our projects? So, we should do work sampling because we can observe an activity for a limited time from the observations and infer how productive the operation is or activity is. In addition, you have to take a small sample of workers from the entire population and every class at a worker is therefore, considered as an observation and therefore, every work sample can result in a multitude of observations.

So, work sampling basically it estimates the percentage of time a labourer is productive relative to the total time the person is involved in the operation. So, the basic principle of work sampling is that based on the presumption that if a sample is taken from a large group, all the characteristics of the group will be a representative of the group, some or all of the characteristics.

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PROCEDURE

1. Classify the worker's activity as one of three modes of activity: value adding work (VA), non-value adding but necessary work (NVAN) (involved in supporting the main activity), and non-value adding work (NVA).
2. Develop a data collection form that will facilitate tallying the observations on site, as shown



So, how we go about doing work sampling the procedure. So, we classify the workers activity in any one of these three modes of activity that is, whether it is can be considered as value added work, non-value adding but necessary work that is supporting the main activity and non-value adding work. So, we write them as VA, NVAN and NVA. Then we develop a data collection form that will facilitate telling the observations on site which I will show later.

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PROCEDURE

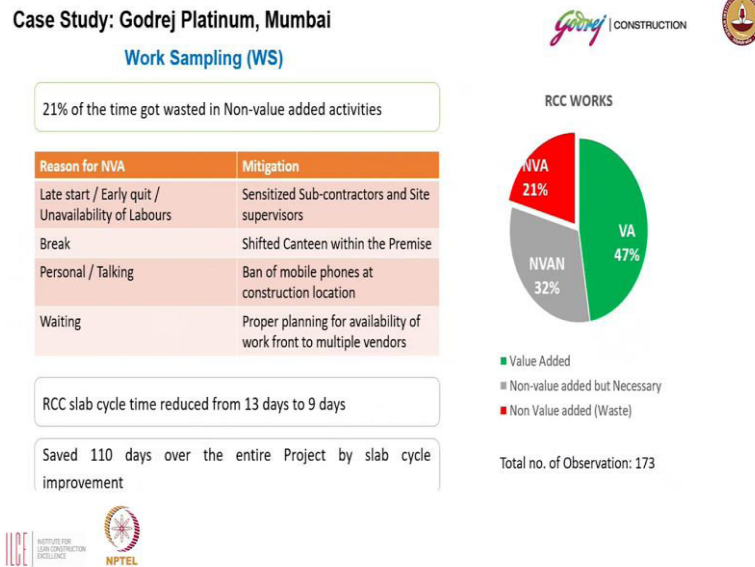
3. Take random observations of workers involved in a given activity in the field. The observation should indicate the workers' activity mode, i.e., productive, non-productive, or semi-productive. Random, for all practical purposes, means without any bias as to who is being observed and that each worker will have the same chance of being observed as any other worker.
4. Record all observations on the form. Enter a checkmark under the appropriate mode of activity observed.
5. Add up all the checkmarks under each work category and calculate the percentage of activity.



Also we take in the third stage random observations of workers involved in a given activity in the field. So, once you record in the fourth stage, all the observations on the form you enter a checkmark under the appropriate mode of activity observed, add up all the checkmarks under

each category and calculate the percentage of the activity which you will understand when I explained the case study.

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So, first thing we did is we targeted RCC works. So, when we did work sampling, we found that the value added activities we are getting is around a percentage is 47, non-value adding activities are 21 percent and non-value adding activities but necessary activities are 32 percent. Now, value adding activities and non-value adding activities which are necessary, these we cannot reduce because they are a main part of the process, but definitely we can reduce the non-value adding activities which are 21 percent.

So, what we did, we further broke down this activities, which I will show in the next slide. And we understood that they comprise of late start early quit, unavailability of labour, taking breaks personal or doing personal work talking, waiting. So, then we found what are the mitigation measures, like for late start early quit, we sensitise the subcontractors and site supervisors to ensure that this does not happen.

Break time was a long time where they used to take nearly one hour, just to go to the canteen and come back, it was a distance away from the project. So, what we did is we made a small canteen within the project. So, it was easy for them to take a tea break and come back. Also talking of on the mobile phone continuously was causing delays. So, what we banned use of mobile work, mobile phones when they were working, because it was also leading to negligence on safety and other care which should be taken.

So, the fourth thing which was we targeted was waiting time. So, this was because of improper planning and non-availability of work front because multiple vendors were working in the same space. So, this helped RCC slab cycle time which was originally 13 days we could reduce it to around 9 days. And it saved 110 days over the entire project just by this lab cycle improvement and the number of observations we took around 173.

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Work Sampling (WS)-RCC



Value Added Activities for RCC



So, an example of what were the value adding activities which example for RCC we were using MIVAN formwork. So, fixing reinforcements, supporting, staging, concreting this can be considered as value adding.

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Work Sampling (WS)



Non-Valued Added but Necessary Activities for RCC



Non-value adding NVAN for RCC is like vibration cleaning of formwork, oiling of formwork, all these activities need to be done. But they can be considered as non-value added but necessary.

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Work Sampling (WS)



Non-Valued Added Activities for RCC



And then completely non-value adding activities like which I explained earlier were waiting for material, talking, late start early quit, et cetera some snaps of our project.

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WORK SAMPLING-GYPSUM



Activity: Gypsum

DATE	VA				NVAN				NVA					
	Borath Coating	Plastering	Applying Gypsum	Others	Cleaning Material	Mixing Material	Handling Material	Transporting	Others	Break's	Talking	Waiting	Others	
07-Sep-18	1	0	2	1	0	1	2	1	0	0	0	1	0	0
08-Sep-18	1	0	1	1	0	1	1	0	0	0	0	0	0	0
09-Sep-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Sep-18	2	0	2	1	0	1	2	1	1	0	0	0	1	0
11-Sep-18	1	0	2	1	0	1	1	0	1	0	0	1	1	1
12-Sep-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Sep-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Sep-18	1	0	1	1	0	1	2	0	1	0	0	1	1	0
15-Sep-18	2	0	2	1	0	1	2	1	0	0	0	2	1	0
16-Sep-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Sep-18	1	0	1	1	0	0	1	0	0	0	0	0	1	0
18-Sep-18	1	0	2	1	0	0	1	0	0	0	0	0	1	0
TOTAL	16	0	16	8	0	8	16	4	4	0	0	6	5	1

	VA	NVAN	NVA
Applying Gypsum	24	21	19
Finishing	8	24	15
Others	4	3	4
Cleaning	4	6	15
Mixing Material	1	15	3
Others	4	4	3
Breaks/Idle	4	6	15
Talking	1	15	3
Waiting	1	15	3
Early quit	1	15	3
Travelling	1	15	3
TOTAL	161	161	161

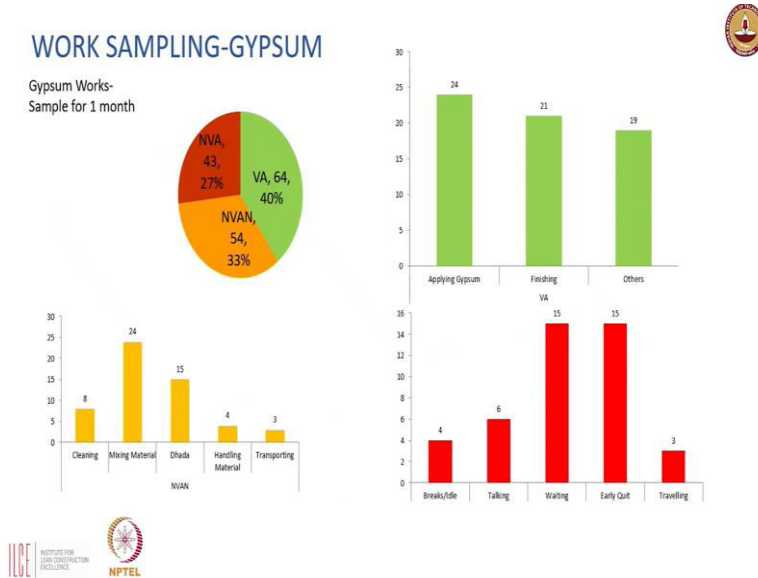
	Percentage
VA	64
NVAN	35.8
NVA	33.5
TOT	26.7



The second we did was on gypsum, which is also considered one of our key activities in finishing. So, our sheet looks something like this every month we were taking observations and categorising various activities as we value adding, non-value added, but necessary and non-value adding. So, all observations which were taken were put in a sheet like this based on

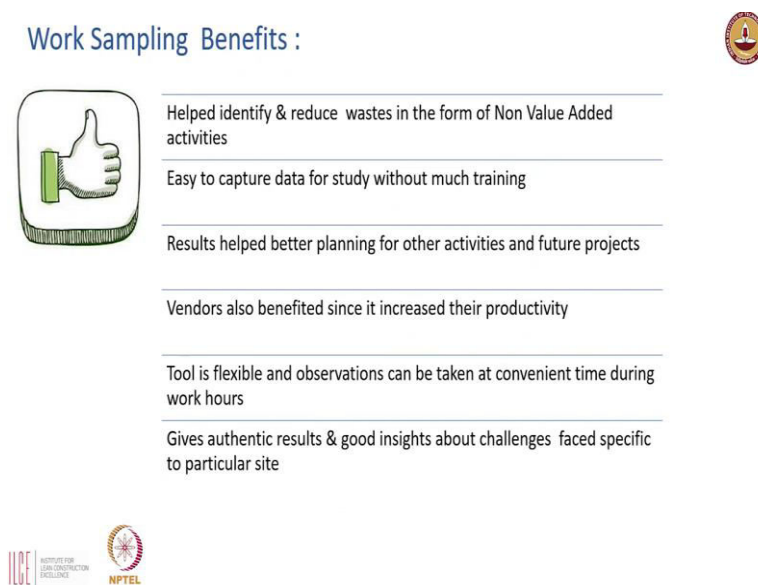
that used to do that totalling tallying and then ways to find out what is the percentage of various, in the various modes of operation.

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So, these were the results, which we found similar to what I explained last time. So, similarly, we targeted the NVA because VA and NVAN are a key activities for the main process. So, we cannot reduce those, but we can reduce non-value adding activities so, this is how it is.

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So, what did work sampling help us to do? So, work sampling helped us to identify and reduce the wastes, which were in the form of non-value adding activities. Also we could capture data for study and we could do this without giving much training to the people who

are taking this observations, they were junior engineers or supervisors, and they could do this very easily, in teams of two days to go and take observations every day.

Also this results helped us for better planning of other activities, because when you are at finishing stage, the same non-value adding activities are there in other activities as well. So, if you address this non-value added activity, it will help across other activities. And this sort of study is very important for future projects as well. Also the vendors were very happy with this study, because it benefited them and increase their productivity.

The best thing about this tool it is flexible and you can take observations at time convenient to you during your work hours, it may not be at a particular, you do not have to be very particular that you go at the same time, you know, same within the same hour or same minute more or less here and there it is flexible. Also it gives you very authentic results and good insights about challenges which need to be addressed specific to that particular project.

Because the same results you might not want to get in one project you might not get it another project, the wastes which are created in one project might not at all be relevant or do not need to be targeted at another project. So, this is very project specific, and it helps you gives you very good insights which nowhere you will get and addressing this will benefit in a long way, like it will help you to improve your productivity levels.

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Work Sampling Challenges



Tool cannot be used for activities of short duration

Chances of wrong data being captured due to workmen changing behavior on seeing the observer.

Need committed efforts of resources deployed for study

Resource and time intensive activity and might not be possible in small teams

Construction labour /team changes may impact consistency in the findings



Some of the challenges I would not call them disadvantages, they are more like challenges, because this tool we feel felt cannot be used for all sorts of activities, specially activities which have short duration or activities which are well on schedule and there is no delay in

then, there is no need to use work sampling. Also the chances, a second point a challenge is that the chances of data being wrongly captured is there because sometimes once the workmen get accustomed to people coming and observing them, they change their behaviour.

So, you might be seeing them doing the this non-value adding activities which you are identifying over the next few observations you might find when people stop talking on mobile when they see you or start working when they see you so, all you have to be very careful when taking this observation at that time because they become very alert. Also need committed efforts of the resources deployed for this study.

So, and also resource and time intensive, work sampling is very resource and time intensive. So, it might not be possible very have a shortage of supervisors engineers, to carry this sort of a study. So, and then finally, what I felt was one of the challenges that the construction team and labour changes and then whatever readings you get, it might be totally you know, different across various contractors as well or various teams.

So, then you have to look at it in totality, and use your judgement, what you get, you to based? What to infer from the data which I have analysed and the results which are coming out. So, it was very nice explaining this work sampling tool to you. I hope based on this, what I have told you think there is merit in deploying this tool at your worksite and 100 percent it will help you reduce waste to a large extent. And thank you everyone for listening to me and all the best to you on your lean implementation journey. Thank you very much.