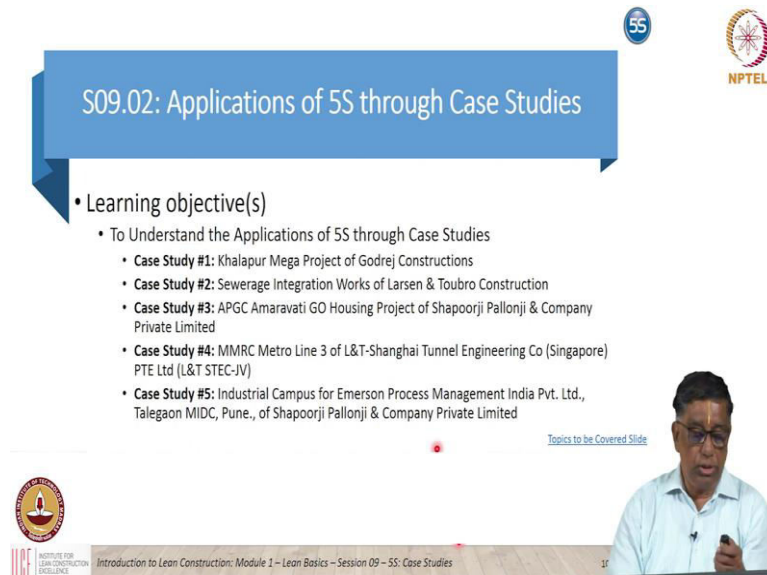


Introduction to Lean Construction
Professor N Raghavan
Department Civil Engineering
Indian Institute of Technology, Madras
Module1 - Lecture 48
Understand the Application of 5S through Case studies_2 cases

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The slide features a blue header with the text "S09.02: Applications of 5S through Case Studies". To the right of the header is a circular "5S" icon and the NPTEL logo. Below the header, the text "Learning objective(s)" is followed by a bulleted list of five case studies. At the bottom left is the IIT Madras logo, and at the bottom right is a small video inset of Professor N Raghavan. The footer contains the text "Introduction to Lean Construction: Module 1 - Lean Basics - Session 09 - 5S: Case Studies" and the number "21".

S09.02: Applications of 5S through Case Studies

• Learning objective(s)

- To Understand the Applications of 5S through Case Studies
 - **Case Study #1:** Khalapur Mega Project of Godrej Constructions
 - **Case Study #2:** Sewerage Integration Works of Larsen & Toubro Construction
 - **Case Study #3:** APGC Amaravati GO Housing Project of Shapoorji Pallonji & Company Private Limited
 - **Case Study #4:** MMRC Metro Line 3 of L&T-Shanghai Tunnel Engineering Co (Singapore) PTE Ltd (L&T STEC-JV)
 - **Case Study #5:** Industrial Campus for Emerson Process Management India Pvt. Ltd., Talegaon MIDC, Pune., of Shapoorji Pallonji & Company Private Limited




[Topics to be Covered Slide](#)

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So far we have been looking at the various concepts of 5S, how to implement them? What can go wrong? What can go well? And now, we look at actually some case studies to make sure that we understand the concepts properly. So, we have five case studies, we have something with Godrej construction, something with Larsen and Toubro and then another with Shapoorji Pallonji and then we have with the Shapoorji, L & T joint venture, and we have finally one more with again Shapoorji Pallonji in a different site.



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 Case Study #1 - Practice of 5S in Khalapur Mega Project of Godrej Constructions  

Objectives:




- To have systematic approach to cleaning, organising and maintaining the work area, improve *Productivity, Safety, and Waste reduction*
- To conduct regular 5S Audits with *% ratings and color codes* for each of the 5 steps to get a clear idea about the specific step which needs improvement as per 5S standards



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So, these are all very interesting case studies. The first study is what is called a Khalapur Mega Project of Godrej construction for a brand-new factory was being set up in a place called Khalapur near Pune. So, there the main objectives of the project were, how do we improve productivity, safety, and reduction of waste? And then they also wanted to conduct regular 5S audits and keep track of the scores, and you know, how to inform the people, how well they have done by you know, color coded audit scores, you know, make it a to make it as something more interesting, what people can see and understand and implement.

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 Methodology  

A) Team Formation:



Based on allocated construction execution area, a team was formed, and area wise *responsibility* distributed within the team





B) Application:

Application started with *in-house stores*

- Accordingly, sort, set in order, shine, standardize and sustain - related 5S journey began
- Subcontractors stores and site premises also covered later under 5S implementation
- A standard checklist was prepared for audit purpose, with % weightage for each of the 5S's



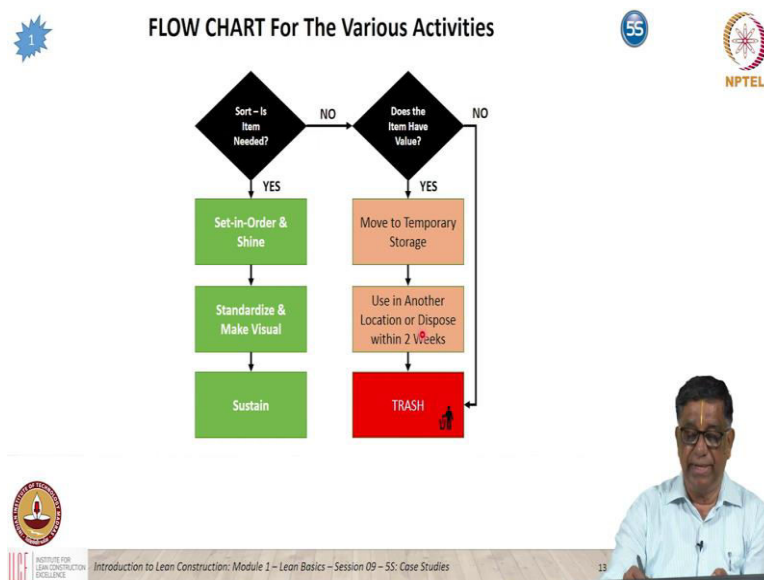
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The first step, they said, is to start formulating teams, to for 5S, they set up teams, S1 team, S2 teams, S5 teams and so on. And then they said they will start with the in-house stores,

because that is where you know, people normally do not keep things properly. And that is where it takes a longer time to find things you want number four Spanner, number five Spanner, you want a bigger screwdriver, a smaller one, so many things, unless they are properly laid out in various places, with proper tags, you will not be able to find materials and tools and tackle that easily.

So accordingly, they started the journey with the 5S's. Of course, the sort, set in order and shine to start with, standardize and sustain later. And they said they will also involve the subcontractors and also covered the site premises, they made with checklist for themselves and for the subcontractors.

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They made a simple flowchart to start with. For example, you look at a particular thing, whether it is required or not required, if it is required, you take it down and keep it in the right place, you set in order, shine, then the continuity by standardizing and make it visual and sustained in the long run.

If something is not required immediately, then not at all required scrap, then you trash it, you send it to trash, if it is something could be useful later, then you move into temporary storage and then over a period of time, you can come back and check again, whether that is useful. A very simple flowchart, but something which sends a message to people how to start doing 5S.

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Glimpses of 5S in Action

5S

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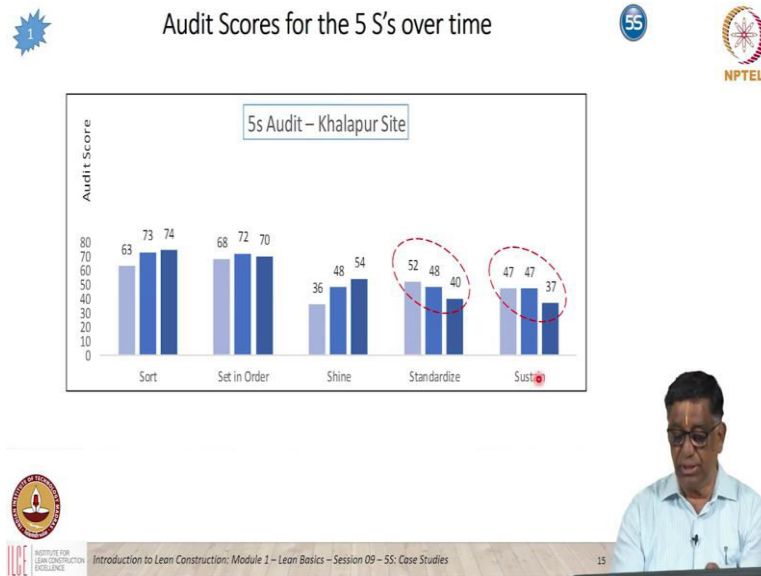
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And if you look at their site later, the way they is stored the steel Diameter wise, and all the waste steel was being stored in a different place and shuttering. Remember one thing shuttering is actually quite expensive. When people remove shuttering from the concrete material, concrete items, they tend to dump it on the ground immediately that tends to get damaged at the reuses number of reuses for an expensive item that comes down.

So, if you are able to keep it properly stored, and then you know, maintain that and then start reusing you get much more number of repetitions, that is very important. For shuttering is a very keen, very important item. And scrap rebar, that is again, something which you can reuse, we need to be careful about that. And the site store, you can obviously see that it is being maintained very well.

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And they had taken separate audit scores for sort, set in order and so on. And then these three bars actually are kind of at different times. Sometimes, you know, the scores are increasing. And for the last two, you know, you will see that they are decreasing. I think the reason is because it is quite difficult to keep doing standardization or sustaining in the long run. Unless very strong procedures, SOPs are in place, these two items do not get done, as well as the first three ones. Labor also tend to understand the first three ones more easily than the last two. So, we need to pay more attention to the last two items, that standardization and sustainability.

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Unacceptable	Poor	Good	Excellent	World Class
No evidence present	Only evident here and there	Absent and evident in most areas	Thoroughly evident and consistent in all areas	Continuously looking for ways to make even more improvements
1	2	3	4	5

Scoring Legend	Green	Yellow	Red
	>=70%	50%-69%	<=49%

Distinguish between what is needed and not needed. Sort out necessary & unnecessary items. The items deemed unnecessary and not being used should be removed from the area (incl. General area, Steel yard, Main Plant area, Office Area, Stores) through the "Red Tag Area".		Rating (1-5)	Remark / Observations against Rating Given
1.	Items/supplies on surfaces have been sorted, separating needed (used frequently) from unneeded (used infrequently or not at all).		
2.	Items/supplies on shelves, have been sorted, separating needed from unneeded (available electronically or not needed at location).		
3.	Items in cupboards or drawers, including desk and file drawers, have been sorted, separating needed from unneeded (available electronically or not needed at location).		
4.	Items on floors have been sorted, separating needed from unneeded eliminating floor piles and all records are safely contained.		
5.	Needed items (in cupboards, drawers, bookshelves, on surfaces, or floors) have been placed at the closest location to where they are used the most to minimize the waste of motion.		
6.	Unneeded items have been removed from the work area.		
7.	Work agreements for the above are documented and all staff know where to find the agreements.		
Total =			

So, far we have been looking at the explanations of 5S and how to do 5S? And so on. We also talked about doing some audits, you know, regularly at the site, by the site people, by people coming from outside, you know, special audits and so on. So, we need to make the points on which, you know, we need to make the audit and they should be standardized. So, anybody at the site, you know, any department head wants to come into the audit for any of the 5S's, they should do on the same standard basis.

So, we need to write down the audit, you know, the reference points, and also give some details about how to give the scores, that is very important, then it can be uniform across the site. And you know, you can compare the audit scores from time to time and see how we are progressing.

If you look at the one typical audit sheet, which they use, you know, site and Godrej construction for sort that is you know, distinguishing between what is needed and what is not needed. So, apart from you know, doing the audit for the various audit reference points. So, you can see at a glance, you know, if use color coding, if you get more than 70 percent you get green, yellow for intermediate and red means not that good.

So, here for sort, we need to identify points about whether, you know, the unwanted things have been removed, the wanted things are you know, get reasonably regularly and so on. So, whether there are procedures for doing the sorting from time to time. So, one can work out once own if each company for each organization, we can develop our own points for the audits. But once you develop it for a particular site or a project, they should be uniform across and keep it except for minor improvements. So, that we have some standardization.

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5S Audit Sheet for Set in Order

Unacceptable No evidence shown	Poor Only evident here and there	Good Adequate and evident in most areas	Excellent Thoroughly evident and applied to all areas	World Class Continuously looking for ways to make even more improvements
1	2	3	4	5

Scoring Legend	Green >=70%	Yellow 50%-69%	Red <=49%
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A place for everything and everything in its place so it should be easy to find	Rating (1-5)	Remark / Observations against Rating Given
1. Locations of needed items are labeled, and items are in correct locations.		
2. Required quantities for needed items are determined including items in Stores, desk drawers and in bookshelves.		
3. Locations for movable items are labeled, and items are placed in correct locations (white board/ laminated card/label on wall can be used).		
4. Visual controls and indicators are established including: Posted map of area, including individual room maps.		
5. There is Labeling indicating contents of shelves at store, drawers and cupboards (a new person should be able to locate without assistance).		
Total =		

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Then the second S, Set in Order, there is a place for everything and everything in its place. Again, we need to make sure that there are proper containers, proper shelves, etcetera, for keeping the various items, they are properly labeled, and whether the things whether the various items are really being kept in those shelves, drawers, and the cupboards and so on. So, that is very important for set in order,

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5S Audit Sheet for Shine

Unacceptable No evidence shown	Poor Only evident here and there	Good Adequate and evident in most areas	Excellent Thoroughly evident and applied to all areas	World Class Continuously looking for ways to make even more improvements
1	2	3	4	5

Scoring Legend	Green >=70%	Yellow 50%-69%	Red <=49%
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Keep work area clean and ready to use. Inspect regularly to ensure sort and set in order are maintained. (Cleaning and looking for ways to keep the workplace clean/organized)	Rating (1-5)	Remark / Observations against Rating Given
1. Work areas and equipment are stocked and organized on a consistent basis according to 5S agreements and schedules.		
2. Members of the work group follow 5S agreements on a daily basis.		
3. Sources and frequency of 5S problems are documented as part of routine work by all staff.		
4. Surfaces are cleaned and clear of dust and debris.		
5. Checklists are utilized to identify ongoing Shine duties and the status of these are up-to-date.		
Total =		


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The third one shine, that is a very important point. So, there again, we need to develop the scoring points for the audit sheets. And again, you know, make them standard across the entire company. So, this is I think should be easier because you know, it can be very well

visible from anywhere, whether the various tools and tackle have been cleaned, shined and so on.


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Unacceptable <small>No evidence present</small>	Poor <small>Only evident here and there</small>	Good <small>Applied and evident in most areas</small>	Excellent <small>Thoroughly evident and applied to all areas</small>	World Class <small>Continuously looking for ways to make even more improvements</small>	
1	2	3	4	5	

Scoring Legend	Green <small>>=70%</small>	Yellow <small>50%-69%</small>	Red <small><=49%</small>
----------------	----------------------------------	----------------------------------	--------------------------------




Maintain the first three S's and have an awareness of improving neatness	Rating (1-5)	Remark / Observations against Rating Given
1. There is a 5S agreement in place and all employees know where it is located.		
2. Leadership can explain why 5S is important.		
3. All staff can explain the importance of 5S.		
4. There is a standard process for training and orienting new staff to the 5S system.		
5. There is a process in place to ensure unnecessary items do not "creep" back into the work area.		
Total =		




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The next one is standardization. Here again, we need to make sure that the people are aware at the site, how exactly 5S has to be practiced, what are the standard norms, what are the standard operating procedures and so on, whether such standardization efforts have been taken up or in place, or being maintained in future also, that is what we need to cover in the audit. So, that has to be again, standard across the site between various people.


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Unacceptable <small>No evidence present</small>	Poor <small>Only evident here and there</small>	Good <small>Applied and evident in most areas</small>	Excellent <small>Thoroughly evident and applied to all areas</small>	World Class <small>Continuously looking for ways to make even more improvements</small>	
1	2	3	4	5	

Scoring Legend	Green <small>>=70%</small>	Yellow <small>50%-69%</small>	Red <small><=49%</small>
----------------	----------------------------------	----------------------------------	--------------------------------




The 5S Discipline is embedded so that it becomes a way of life. 5S is no longer an event but routine.	Rating (1-5)	Remark / Observations against Rating Given
1. 5S plans and action updates are clearly displayed and current		
2. Success stories are displayed and confirmed for improvement		
3. Staff 5S roles are clearly identified.		
4. Department audits and subsequent improvement plans are displayed and current		
5. Are work instructions and procedures available in the workplace regularly reviewed / kept up to date?		
6. Are display boards, activity charts, notice boards, etc. up to date and regularly checked?		
Total =		



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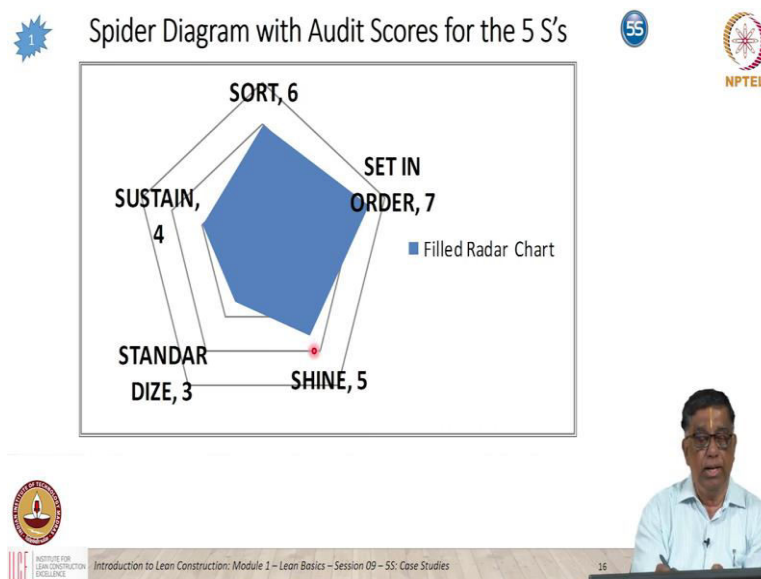


And finally, we come to sustain whether everybody is doing 5S on their own, that needs to be judged again by proper audit. And as the audit the points have to be developed accordingly, whether there are enough signboards for reminding people, whether people are doing it on their own, whether there is a 5S culture prevalent at the site. So, these are some other points which should be covered in the audit sheet.

So, we can have regular audits which are covering all these points. And we also may have special audits with different kind of scoring points. For example, people coming from head office, so one should ask them to do their own scoring for a special audit. So, that could have different scoring patterns, apart from what we are shown here for the standard audits, depends every site has to develop its own norms, its own practices.

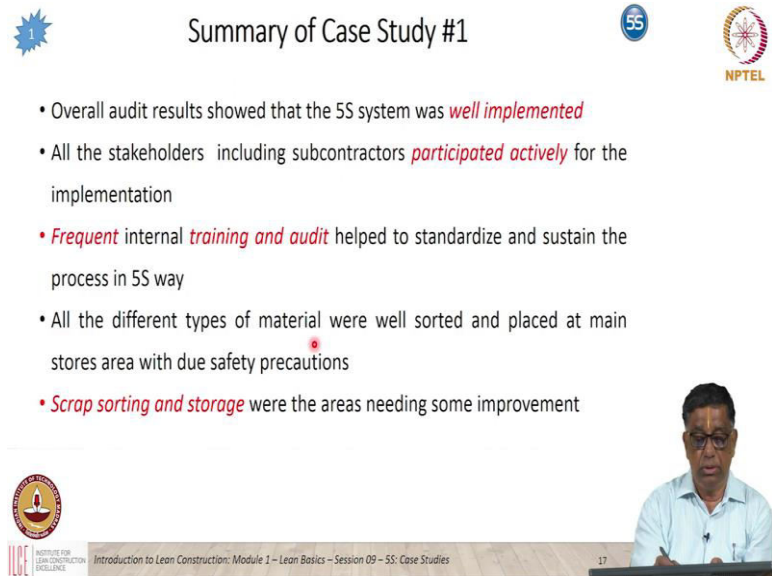
But the basic idea is keep checking from time to time, how you are progressing with 5S, and then have the checking pattern, the standard norms, which are common across the site, and then keep improving all the time. That is the motto of Lean, continuous improvement.

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It is a very interesting way of showing all these scores in a single diagram is called a spider diagram. So, we have sort, sustain, sort, set in order, shine, and so on. And these lines the further is out, is having a better score, the more comes in words, that means has a lesser score. A spider diagram gives you an immediate idea of what is being done well, and what can be improved.

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The slide features a blue star icon with the number '1' in the top left corner. The title 'Summary of Case Study #1' is centered at the top. To the right of the title are two circular logos: one with '5S' and another with 'NPTEL'. The main content consists of four bullet points. At the bottom left is the ILCE logo, and at the bottom right is a video inset of a man in a light blue shirt. The footer contains the text 'Introduction to Lean Construction: Module 1 – Lean Basics – Session 09 – 5S: Case Studies' and the page number '17'.

1

Summary of Case Study #1

- Overall audit results showed that the 5S system was *well implemented*
- All the stakeholders including subcontractors *participated actively* for the implementation
- *Frequent* internal *training and audit* helped to standardize and sustain the process in 5S way
- All the different types of material were well sorted and placed at main stores area with due safety precautions
- *Scrap sorting and storage* were the areas needing some improvement

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That is the basic idea. And the summary of this exercise, reasonably well done, well implemented, anything more than 50 percent audit score is a good one. And all the subcontractors also participated quite well in the site. And they had frequent training and audit maybe every one or two weeks, they conducted regularly. And they found that the materials were very well sorted, and the site stores, they could reach out materials or tools and tackles quite easily.

So, they were quite happy with that, and they were also able to recover a good extent of scrap, which used to go out earlier as something useless, they could also get some value out of the scrap. So, these were the learnings and benefits in this Khalapur site with a good practice and going on quite well.

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Case Study #2 - Sewerage Integration Works of Larsen & Toubro Construction




- Need for the Study**
 - To create a Work Environment that is *Disciplined, Clean and Well Ordered*
 - Ensure "*Place for Everything and Placing Everything in its Place*"
- Objectives**
 - Eliminate the *Wastes* Produced in Site by *Sorting* out items and aligning them in *Order*, depending upon their *Usage*




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The second case study I would like to talk about is at a Larsen and Toubro site, in a place called Bharagpur in West Bengal is actually a sewerage integration work. And there they said, they would like to have a well-disciplined way of working, they will like to keep the site clean and well ordered, and they wanted to implement this place for everything and everything is placed quite seriously. And consequently, they would eliminate the waste. And by sorting out and setting an order and then depending upon the actual usage of the various materials.

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Methodology





- The site *implemented* 5S in 18MLD, 6MLD STP and in Main site office area
- Site conducted several 5S *audits* at an interval of 15 days between the audits
- *Specific Auditors* were appointed to conduct 5S audits and ensure that it is followed properly throughout the entire location


5S Log Sheet


	Sort	Set in order	Shine	Standardize	Sustain	Total
Before	51%	52%	44%	48%	50%	49%
After	51%	52%	48%	52%	53%	51%
As on date	54%	60%	52%	56%	56%	56%

Poster at 18MLD




Poster at Main Office





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Glimpses of 5S in Action

5S



- Sorting and Tagging resulted in *locating* the items in a better and easy way. It has added a very attractive look to the overall site
- *Housekeeping* was found to be improved both at site & office premises

Sorting of Materials

BEFORE

AFTER (AS ON DATE)



Clean Workplace 18MLD



Tagging of Materials

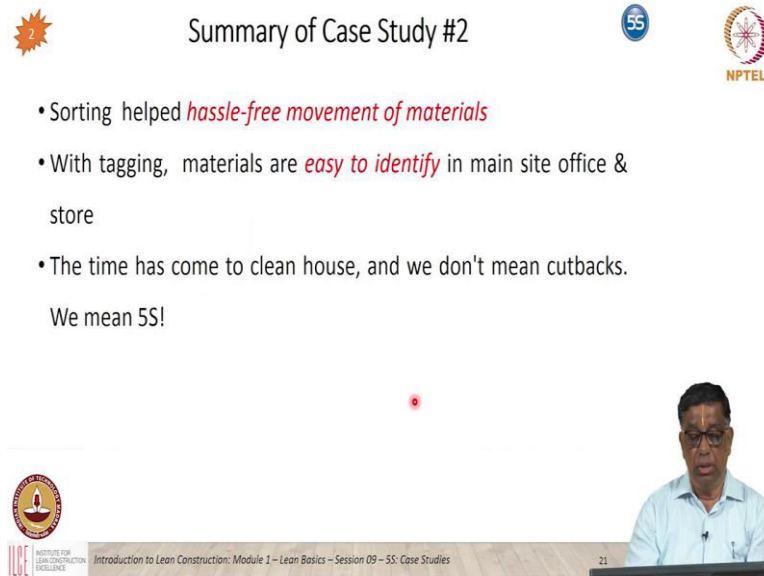


So, the head this 18 MLD and 6 MLD plants where they implemented and they also implemented in the main site stores area. Site conducted actually several 5S audits at intervals of about two weeks between audits and they had specific auditors who were actually appointed to conduct 5S and make sure that it is done properly. And these actually are the scores which they had for the 5S's before, after, you can see that standing from 50 percent around 50 percent for all the 5S's.

I would say the good score to start with and possibly over long usage, it must gone beyond 60 or even 70 percent. And they put a big banner there for this for example says 5S to success. That is a good slogan, 5S to success, and they had many banners and posters in various places. And we can see clearly that the before and after pictures are showing the considerable benefits which they got by practicing 5S, a great benefit they found was by tagging, see, you send a stranger to the store, ask him to bring back a particular tool. If you can do that quickly, that shows you have done your 5S quite well.

Because he will know immediately where the item is stored. It is also properly tagged, for tagging is also very important, what it does. And the entire site, that looks quite nice, neat and tidy, that gives a very good impression. So, housekeeping was also going to be very much improved with all the practice.

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Summary of Case Study #2

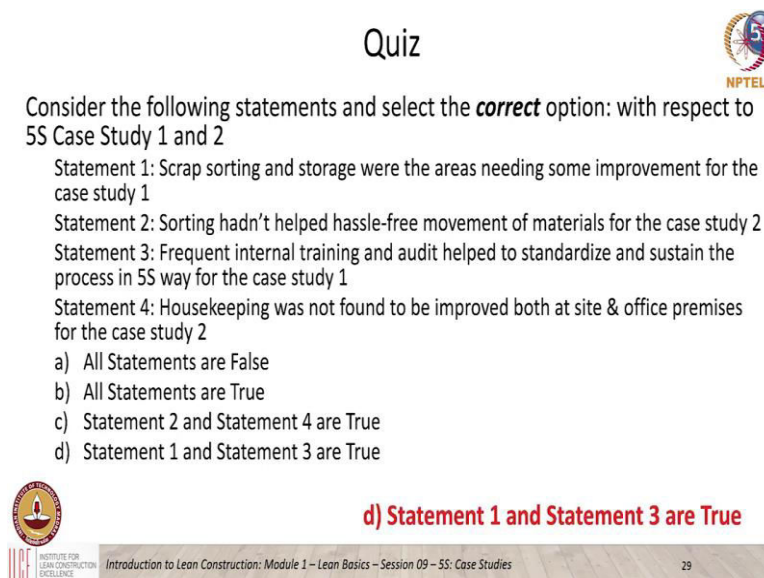
- Sorting helped *hassle-free movement of materials*
- With tagging, materials are *easy to identify* in main site office & store
- The time has come to clean house, and we don't mean cutbacks.
We mean 5S!

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So finally, they said they are able to do hassle-free movement of materials because they were keeping track of the materials by visual management. And with tagging. The materials were easy to identify in the main site office and also the main site stores and everything looked very clean, tidy, and people are quite happy to practice 5S. So, these two sites have demonstrated that 5S is easy to practice and people got good amount of benefits by practicing it.

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Quiz

Consider the following statements and select the **correct** option: with respect to 5S Case Study 1 and 2

Statement 1: Scrap sorting and storage were the areas needing some improvement for the case study 1

Statement 2: Sorting hadn't helped hassle-free movement of materials for the case study 2

Statement 3: Frequent internal training and audit helped to standardize and sustain the process in 5S way for the case study 1

Statement 4: Housekeeping was not found to be improved both at site & office premises for the case study 2

a) All Statements are False
b) All Statements are True
c) Statement 2 and Statement 4 are True
d) Statement 1 and Statement 3 are True

d) Statement 1 and Statement 3 are True

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Supplementary Module

Link (to read and contribute)
<https://tinyurl.com/yemou3g5>

