



Measurement Of Percentage Of Activities Completed And Causes Of Non-Compliance

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Abstract

In Colombia, the last planner planning tool is being given the opportunity to adopt the measurements of plan accomplished and root cause, many universities in the country have been conducting this type of studies so that systems such as last planner are incorporated in the diary of each construction site. In this study an investigation of the activities performed daily during 3 weeks in the month of December of phase 3 of the construction project which consisted of making a schedule of the activities performed to identify those that were fulfilled and not fulfilled during the week, to calculate the percentage of activities %PAC and the causes of non-compliance. Finally, an analysis of the results was made, obtaining a total average of 60% of PAC and the cause that most affects the non-compliance of the activities is poor planning.

Keywords: percentage; compliance; causes; activities; planning.

1. Introduction

Today in developed countries such as the United States, Spain and the United Kingdom have changed the course of the construction sector because they have observed that the productivity curve (Rojas Perez, L. E. (2019) and waste was going down a bad path, leaving the name of engineering and construction in a sector of low productivity and performance in projects (Pinedo Angulo, D., & Elespuru Rodríguez, V. (2019), which means that the economic losses due to the disorganization of the companies was quite high, generating a concern to direct these companies to improvement and quality.

In this way they observed that the commitments acquired by ineffective quality controls did not give guarantee to the committed deliveries in the first instance, generating a breach and above all looking bad before the customers; the low skilled labor compared to the manufacturing industry even more

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worsened the situation, it seems impossible but the truth is that there is a lack of coordination and transparency between the different stakeholders and the very good corruption in the countries helps this to be seen in an even more unfavorable state for the construction sector (Herrera, M. K. I. F., Portillo, M. T. E., López, R. R., & Gómez, J. A. H. 2019).

Also so, productivity (Martínez Cedeño, D. (2019) was affected due to the few controls that have been imposed for the execution of works, it is important here to see the history of how Toyota and Japan have overcome the obstacles that have been presented to them, it is important that as a company the vision of planning is even broader, it is how most countries have solved their problems of reducing costs, planning and controlling construction works, increasing productivity reaching the manufacturing industry that in statistics is always above construction (Padilla, L. 2010).

In the construction industry (Pons Achell, J. F., & Rubio Pérez, I. (2019). has been implementing tools that can improve the planning processes of the works which is known as Last Planner System (Valencia, R. F. H., & Pereira, C. R. (2017), a tool based on the Lean Construction philosophy (Pozo Díaz, R. S. (2016) or Construction without losses that has been continuously improving the planning processes of the works.

Last planner system (Moyano Mendiburu, K. M., & Ventura Inga, J. M. (2019) is a planning system that is applied to the works in a collaborative way helping to improve the processes through a general, intermediate and weekly planning (Quiroga Leon, C. A. (2015). It also consists in that each of these plans (Díaz, L., Oliveira, M. D., Pucharelli, P., & Pinzón, J. (2019) are elaborated collaboratively face to face, through a pull session (Ramirez Seguil, A. P. (2020), which allows visualizing the activities to be executed, the pending restrictions, problems or unforeseen events, in order to solve them in time and in an organized manner.

Therefore, in order to apply these tools, it is important to perform measurements and find the root cause (Ramos vera, a. B. (2021) of the non-compliance of the activities (Cruz Delgado, C. M. (2019).

2. Method

2.1. Project under study

This investigation is carried out for a construction project in the city of Cucuta called "Civil Engineering Building", which consists of 4 floors for classrooms and event rooms.

A sample of 3 weeks is taken in Phase 3 of the project for the following measurements:

- Calculation of percentage of activities completed.
- Diagnosis of causes of non-compliance

2.2. Calculation of percentage of plan completed or %PAC

For the CAP analysis, the calculation is made using Equation N°1

Equation 1. CAP calculation

$$\% PAC = \frac{\text{Number of activities completed}}{\text{Number of programmed activities}} \times 100$$

Source. taken from (Miranda Mejia, M., Torobisco Vilca, E., & Gomez Minaya, R. 2020).

2.3. Diagnosis of causes of non-compliance

According to the categories offered by Juan Felipe Pons in his last planner system book (Díaz Montecino, D. A. (2007), the diagnosis of causes of non-compliance is carried out, which generates a weekly plan format. The most frequent results are analyzed and improvement actions are taken.

3. Results and discussion

3.1 Calculation of the percentage of the plan fulfilled

3.1.1. Compilation of information

Table 1 shows the activities executed and not executed for week 1.

Table 1. Schedule of activities week 1.

Weekly Activities	Weekly 1						Fulfilled		Causes of noncompliance	
	M	T	W	T	F	S	Yes	No	A	B
Columns formwork for auditorium level 4 mezzanine plate 3							x			
Substation activities started (excavation of trench for electricity pipe)								x	x	x
Shaping and steel reinforcement of columns of auditorium mezzanine level 3							x			
Cleaning of warehouse							x			
Casting of auditorium columns								x	x	x

Note: A: Poor planning; B: Lack of supervision.

Source. Own elaboration

As can be seen in Table 1, the schedule of activities for week 1 shows 3 activities that were completed and 2 that were not completed.

For the calculation of the percentage of completed activities, it was observed which activities were not completed as expected by those in charge of the work.

Out of 5 activities expected by the master and the engineer in charge, 3 were carried out; and one of these was not within the stipulated schedule for this week, therefore, the activities that were not completed should be carried out the following week.

It can be analyzed that time was spent on activities that did not generate value to the project at that time, this happens when a traditional planning is done, activities such as cleaning the warehouse, and the excavation of the trench, were executed for not having planned the week,

The assumption that the steel reinforcement of the columns and their formwork could not be executed because the excavation of the trench had to be done simultaneously with the excavation of the foundation of the substation, since if the latter is finished first, it would have to wait until the excavation of the foundation is finished in order to be able to continue.

Next, the % PAC of the executed activities is calculated by means of the following equation.

Equation 1. Calculation of %PAC

$$\%PAC = \frac{\text{Number of activities completed}}{\text{Number of programmed activities}} \times 100$$

$$\%PAC = \frac{3}{5} \times 100$$

$$PAC = 60\%$$

In this case, it was verbally planned that the activity of shaping and steel reinforcement, column formwork and casting would be carried out, which was not fulfilled with the casting of columns in the auditorium, therefore, the percentage of the plan completed is 60%: 60% which means that the activities that have been planned to be performed during the week are not being successfully fulfilled and therefore others are performed that do not generate value to the activity that needs to be executed at that time of the project, this lack of planning generates a waste of cost, time, quality and therefore slows down the continuous improvement.

Table 2 shows the results obtained in week 2 under study.

Table 2. Chronogram of activities week 2.

Weekly Activities	Weekly 2						Fulfilled		Causes of noncompliance			
	M	T	W	T	F	S	Yes	No	A	B	C	D
	Casting of columns of plate level 3 of the auditorium.							x				
Trench excavation for electrical conduit							x					
Forming, reinforcing steel reinforcement for mezzanine 3 columns structure 1								x	x		x	
Installation of formwork for mezzanine columns 3 structure 1								x	x	x	x	
Installation of auditorium plate table 4								x	x		x	x

Note: A: Poor planning; B: Lack of supervision; C: Completion of a previous job; D: Lack of materials, equipment, scaffolding, etc.

Source. Own elaboration

Calculating the percentage of completed activities, it can be seen that out of the 5 activities expected for this week, only 2 were completed, namely the casting and 70% of the excavation

of the trench, but this activity should have been carried out the previous week. It was expected that 80% of the steel reinforcement and column formwork would have been completed, but it was not.

This week's CAP is calculated below:

$$\%PAC = \frac{\text{Number of activities completed}}{\text{Number of programmed activities}} \times 100$$

$$\%PAC = \frac{2}{5} \times 100$$

$$PAC = 40\%$$

According to the results obtained, the %PAC for this week is 40%, a very low percentage for a project under execution.

Table 3 shows the results obtained in week 3 under study.

Table 3. Schedule of activities week 3.

Date: December 21-24, 2020	Weekly 3						Fulfilled		Causes of noncompliance			
	M	T	W	T	F	S	Yes	No	A	C	D	
Figured, reinforcing steel reinforcement for mezzanine columns 3 structure 1								x				
Structure column formwork 1								x				
Substation foundation excavation								x				
Casting of columns of structure 1								x				
Installation of auditorium plate table 4									x	x	x	x

Note: A: Poor planning; C: Completion of a previous job; D: Lack of materials, equipment, scaffolding, etc.

Source. Own elaboration

During this week, work was carried out until December 24, half day, out of 5 activities: Excavation of substation foundations, reinforcement-forming of columns and casting of columns; 4 activities were completed.

From the previous week the installation of the table of the auditorium plate was pending, this activity was not carried out this week, therefore, it is an activity that is pending.

$$\%PAC = \frac{\text{Number of activities completed}}{\text{Number of programmed activities}} \times 100$$

$$\%PAC = \frac{4}{5} \times 100$$

$$PAC = 80\%$$

The PAC calculation showed that 80% of the expected activities were overdue, although the fact that these activities were completed does not mean that this result is favorable; for the result to be favorable for the project, activities that are committed to be carried out must be completed and these activities that were executed are overdue, i.e., it is a positive but negative result at the same time, it is actually zero (0) for the project.

3.2. *Diagnosis of causes of non-compliance*

3.2.1. *Week 1*

According to what has been observed and analyzed, the activities executed and the category of causes of non-compliance, Table 1 shows that the causes of non-compliance of the activities of week 1 are due to non-robust planning and lack of supervision.

3.2.2. *Week 2*

According to what was observed and analyzed in the executed activities and with the category of causes of non-compliance, it is observed in table 2 that the non-compliant activities of week 2 are due to lack of robust planning, lack of supervision, completion of a previous job and lack of materials.

3.2.3. *Week 3*

According to what was observed and analyzed in the activities performed and with the category of causes of non-compliance, Table 3 shows that the causes of non-compliance of the activities of week 3 are due to non-robust planning, completion of a previous job, lack of materials and lack of equipment.

3.3. *General summary of results*

The following table shows the results obtained during the 7 weeks under study.

Table 4. Summary of %PAC results and causes of non-compliance

Summary of causes of non-compliance and %PAC					
Weekly	1	2	3	...	Total
Programmed activities	5	5	5		
Completed activities	3	2	4		
PPC or PAC	60%	40%	80%		
PPC or PAC accumulated	60%	100%	180%		60%
Causes of noncompliance					
Poor planning	x	x	x	3	

Lack of supervision	x	x		2
Completion of a previous job		x	x	2
Materials, tools and equipment		x	x	2

Source. Own elaboration

5. Conclusions

The lowest percentage was in week 2 with 40% of the plan completed, this percentage is too low for the project and we see that when starting with a delay the values will improve over time.

In general, we have an average percentage of plan completion of 60%, which could be improved, but for that an analysis of the causes of non-compliance was made, which can be concluded that according to the categories of the most frequent causes of non-compliance are: Poor Planning (A), Lack of supervision (B), Completion of a previous job (C) and Materials, tools and equipment (D) (Pons Achell, J. F., & Rubio Pérez, I. (2019) the least frequent. These results and conditions show that an improvement in organization, activity planning and activity control is needed.

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