

LAST PLANNER AS A SITE OPERATIONS TOOL

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INTRODUCTION

The objective of this paper is to demonstrate the main results obtained with the application and concepts of Lean Construction to the operations of Verticon Construção e Empreendimentos Ltda., especially those based on new management tools and decision taking. We will present the example of a site construction in which we are applying the concept of lean working as the basis for decreasing costs and terms, and improving the quality level perceived by our clients.

Verticon Construção e Empreendimentos Ltda. was founded in 1985, and acts in the sector of civil engineering for commercial, residential and industrial constructions; the company has presented a solid, gradual and significant growth in these areas for the last decade.

At the end of 1996, our company adopted the strategy of developing qualifications to meet the needs of some special groups of that, according to the nature of their operations, rhythm of growth or even enterprise philosophy, were seeking civil engineering companies to establish partnerships.

Therefore, we have tried to detect work opportunities for our segment in the market and, based on this survey, to study the best ways to adequate our company to a higher level of competition.

Analyzing our potential clients, we verified that all companies—despite their peculiarities—had basic needs in common:

- short terms for execution;
- high volumes of service of the same standard;
- commercial relationship based on gain as a function of transaction volume (scale economy);
- sites of construction distant from each other and from our head office;
- deficient quality of projects, generally generated due to lack of time to adequate development;
- lack of agility for taking decisions internally, resulting in increased uncertainty in relation to planning and programming subsequent activities;
- high standards of quality required for products and services;
- Legal, neighbor and climate conditions problems, factors that generally interfere in the sequence and term of the activities, but that cannot be reasons for requesting occasional extension of term or loss of quality;

As a function of the above mentioned variables, we have decided for qualification through improvement of our model of management, as from the implementation of a comprehensive program for improving Productivity and Quality in our fronts of service. To do so, Verticon has contracted in February 1997 the company Logical Systems Consultoria S/C Ltda., whose director is Eng. Antonio Sergio Itri Conte, a member of IGLC since 1994.

Our plan of attack was based on the application of the concepts of Lean Construction that consists in the following points:

- improvement of the systems for information and control;
- investments in adequate software and hardware;
- development of internal teams dedicated to the Planning and Control area;
- preparation of the site teams for a model of management based on agility for detecting and correcting deviations in relation to the plans;
- development and awareness of suppliers of services and materials;
- creation of an internal connection between sites and head offices via Internet;
- investments in programs of Work Safety and Hygiene (NR-18)
- investment in new technologies;
- training of the team in Management according to Total Quality;
- creation of an specific organizational function for the development, coordination and critical analysis of projects;
- examination and analysis of the real consumption for each service, with the objective of creating reference standards for each type of construction.

We are currently developing an advanced program of Total Quality, aiming to obtain Certification ISO9002.

NEW MODEL OF PRODUCTION MANAGEMENT

In the development of a new model of production management, based on the concepts of Lean Construction, the first concern is to make the operational environment stable, through a new design of the organization and valorization of the functions of planning and control.

The traditional function of the site coordinator was eliminated, reducing the management levels and optimizing the process of decision taking of the organization as a whole. In this scenario, the contract manager began to be responsible by the operational performance of the enterprise under his responsibility, as well as the management of the planning, services schedule and the logistic of the fronts of work. The foreman is responsible for guaranteeing the rhythm and quality of the services, systematically aiming the optimization of allocation of the available recourses (labor, materials, and service suppliers) for the different fronts of work under development.

According to the new concept, the enterprise begins during the phase of budgeting, when our planning and logistic manager, together with the contract manager and budget team, define the following points:

- project of the site;
- definition of the infrastructure necessary to execute the construction, including:
 - energy, water and sewerage systems;
 - infrastructure for communications in the site;
 - trustful and qualified local suppliers;

- access and flow of materials inside the site;
- arrangements to conform the site to the ideal conditions of work safety and hygiene;
- execution methodology aiming the requirements for term and quality;
- execution plans of the construction with the objective of budgeting according to the execution, as well as of giving consistency to the compromise of everybody with the term foreseen for the work.

Thus, the Executive Planning is consolidated, being a source of reference information for the processes of decision taking during the development of the construction.

EXAMPLE OF APPLICATION

In this paper, the option was to analyze a construction project that was executed using the Last Planner technique as the basic tool of Planning, Program and Follow up of the Operational Development.

This construction, a McDonald's restaurant at Avenida Ayrton Senna, Rio de Janeiro, was executed in an area of 2400 m², in which it was necessary to change the soil because of the bad quality of the original soil; the project consisted of a store according to standard SS301, that is, "Drive Thru", one floor, constructed area of 397 m² and capacity for 150 persons.

The foundations of the building were done with pre-molded stakes of concrete, the retaining wall with metal stakes, the structure with structural masonry and the roof with metal structure. Internal lining followed the standardization of McDonald's in Brazil, that is, ceramic floor, mass walls, ceramic, formic, wood details and modular ceiling. Power of the site is 300 KVA.

Contractual term of execution was 90 days.

PRODUCTION MANAGEMENT MODEL

The first measure after negotiation was the development of a schedule, based on the data consolidated in the Executive Planning, which had already been developed and assimilated by everyone involved, specially the engineer responsible for contract management. To do so, the activities necessary to execute the construction were listed, as well as the precedence relations and the respective terms, which constituted a service program based on the CPM technique.

According to the model, it was assumed that the uncertainty generated by the fact that a CPM net does not reflect the flow difficulties to feedback the different productive processes would be compensated for by the use of Lookahead tables and Daily Plan. These were updated every week and permitted the complete control of the needs for each front of work by the responsible engineer and the foreman, with the following advantages:

- monitoring of the desired rhythm of each job;
- optimization of working teams available in each stage of the construction;
- stabilization of the operational environment, decreasing the number of surprises during the activities;

- decreasing quantity of raw material stored in the site.

Due to the fact that the construction had a short term, approximately three months, this schedule was executed with daily precision, and was sub-divided into areas of control: external, building, façade and general items.

In the sub-item building, the sub-division of services made after the application of mass in the walls was made per environment, that is, details for each environment, floor, walls, lining, electrical services, plumbing, HVAC, equipment, etc.

The cycle of production management for this construction can be summarized through the weekly meetings called by the site manager, with the support of the foreman and occasionally with the participation of representatives of sub-contractors. The following stages are executed:

- **Lookahead**

Based on the CPM net that had been reviewed the previous week, the services to be executed during the next two weeks are determined, being that daily details are given for the following two weeks. The main objective of this document is to allow that future needs of material, equipment and labor are anticipated, avoiding to increase the level of stock and occasional stop due to lack of input.

- **Daily Plan**

Based on the Lookahead, the site manager, together with the foreman, executes the Daily Plan, which basically consists in listing the works to be performed during the following week, indicating the dates of execution and the team to be used for each work.

- **PPC (Percent Planned Completed)**

When the Daily Plan is executed, an analysis of the report of the previous week is made, and the PPC is calculated by dividing the quantity of works effectively executed by the total quantity of works that had been foreseen.

A note explaining the reasons justifies any work that had been foreseen but was not executed.

When the PPC is calculated, a re-programming of the services is made, indicating the services that had already been executed and those that had been foreseen but were not executed. The immediate result of this re-programming is the calculation of a new date for finishing the construction.

When these data are available, the Plan Team prepares three figures. Figure 1 shows to the Plan team if the date foreseen to finish the construction is stable or if the construction shows a tendency of being delayed, or else, if it is possible to advance the delivery.

Figure 2 essentially shows the quantity of planning, based on the quality of allocation of the available resources to the different fronts of work.

Figure 3 shows the importance degree of the identified non-conformity, which will be the basis for analysis and improvement.

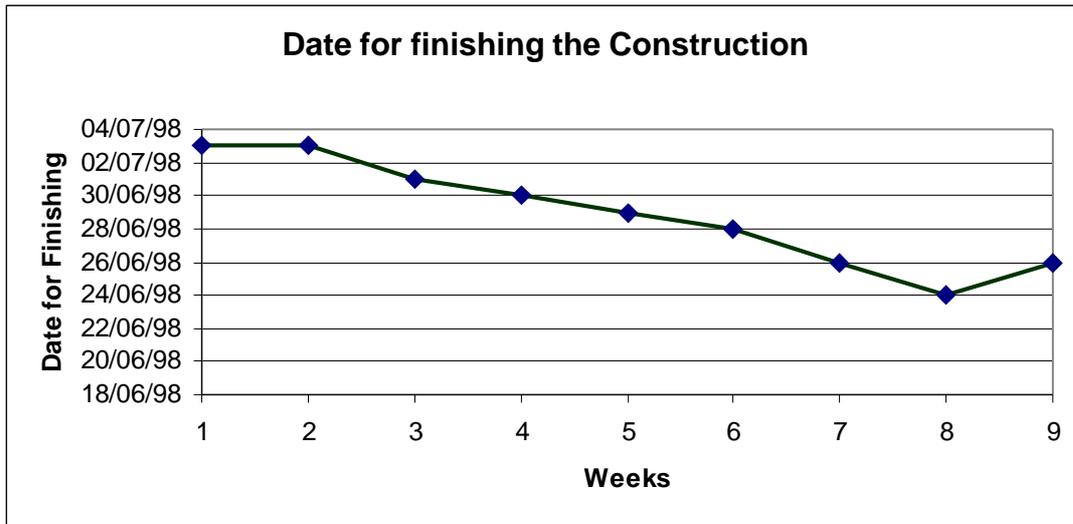


Figure 1

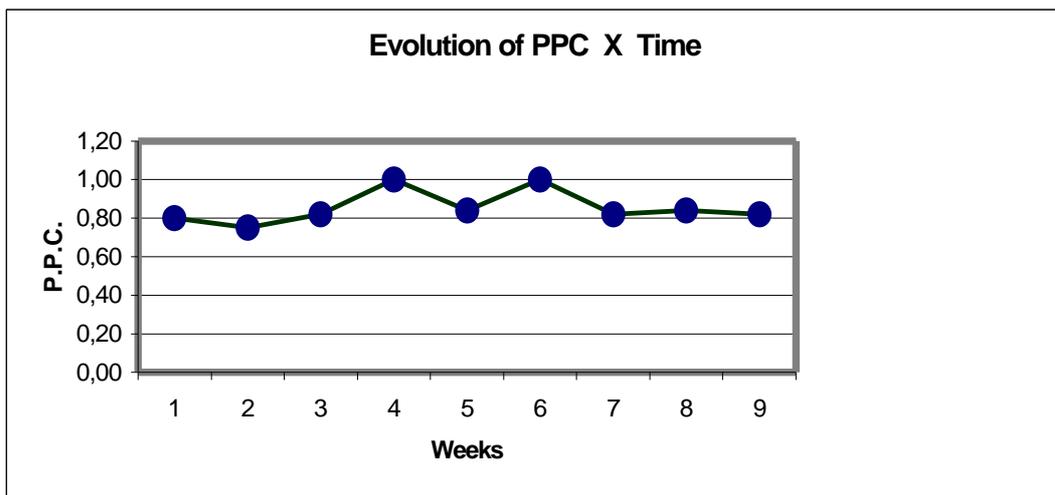


Figure 2

MAIN RESULTS

In this case, the results obtained with this technique were:

- decrease of the term from 90 (ninety) days to 83 (eighty three) days;
- decrease of services to be re-done;
- better allocation of resources in the time so as to reduce interference among working teams;
- better organization of the site because the team is aware of what to do and when to do (Daily Plan);
- possibility of informing the client, after 30 to 40 days, of the availability of advancing the date, so as McDonald's is able to re-program the delivery of

equipment and services under their responsibility, training the team, etc., so that the restaurant can be inaugurated before the foreseen date;

- approximately 25% decrease in the number of hours of the management team (site manager and foreman) during the last two weeks;
- 70 to 80% decrease of items that presented discrepancy to the Punch List, resulting in a shorter term for meeting these requirements. In this construction, the items that presented discrepancy had the requirements met within 1 day, being that for similar constructions, it takes from 3 to 5 days.

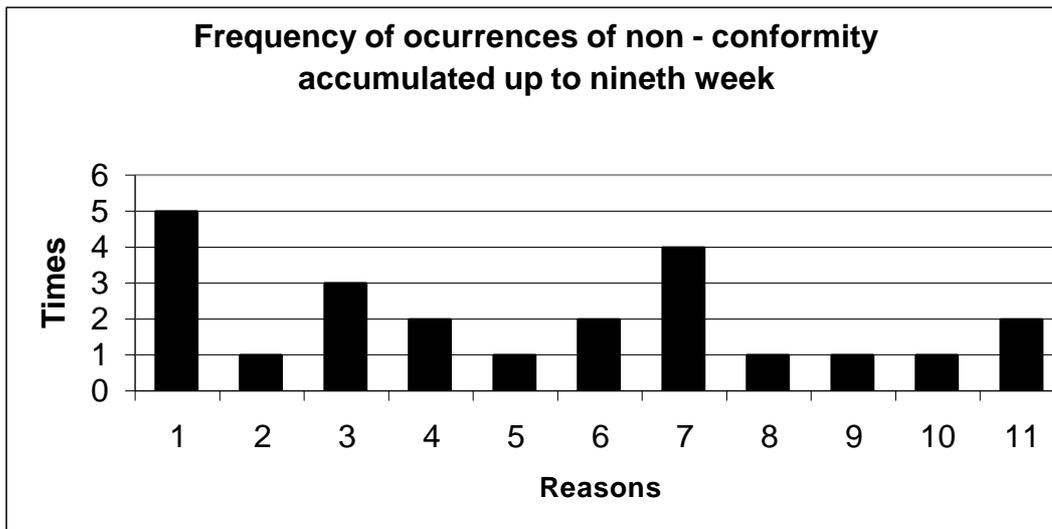


Figure 3: Explanation: because of 1 we had 5 services that were not executed, because of 2 we had 1 service that was not executed, because of 3 we had 3 services that were not executed, and so on.

NEXT STAGES

At this moment, when the first substantial results of the utilization of this technique begin to be felt in every sites of the company, our next challenges are:

- to improve the real cost of each service in our sites. To do so, personnel of the Budget Department are already present in some of our sites checking our real cost compositions of services, allowing to estimate the cost decrease obtained with the new techniques of planning and consolidate the knowledge acquired for future constructions;
- to improve labor allocation and definition of working-teams;
- to stabilize the quality levels obtained in each stage of the productive process.

Currently, we already have in our company several cases of Lean Construction applied in constructions and real state enterprises.

We understand that the future of civil engineering companies is related to the technological and management qualification of their teams. Therefore, the consolidation of the concepts of Lean Construction is the course we have chosen to picture a successful horizon for our company.